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AUTHOR Blitzer, Robert F.
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ABSTRACT

This dissertation describes the development and evaluation of course materials entitled "Confluent Math: A Multidisciplinary Thinking-Feeling Approach to Twentieth Century Mathematics." The goals of the materials were: (1) to develop understanding and appreciation of logical axiomatic structure; (2) to examine major philosophic ideas relating to the creation of axiomatic structure; and (3) to help students gain increased self-awareness. Pre- and post-tests show an upward shift in mathematical attitudes and understanding the nature of mathematics as an abstract art form. Unit topics include: introduction to mathematics, infinity, symbolic logic, group theory, external reality, and the inductive method. (MP)

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The Development and Evaluation of An Interdisciplinary Cognitive-Affective Approach to General Education Mathematics

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ROBERT F. BLITZER

A MAJOR APPLIED RESEARCH PROJECT
PRESENTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF EDUCATION

NOVA UNIVERSITY

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ACKNOWLEDGEMENTS

Three persons are directly responsible for facilitating the process involved in the document that follows. Without these people the MARP would have fallen somewhere on a continuum between "difficult" and "impossible."

Ms. Jane Morganroth, secretary of the Department of Mathematics at Miami-Dade Community College North, typed both the Confluent Math product and the MARP based on research generated by the product. The reader who surveys the enormity of Confluent Math (submitted as a separate document in limited edition along with the MARP) should quickly get a feeling for Ms. Morganroth's skills and ambition. This product is the third version of Confluent Math, with earlier drafts revised by student critiques over a two year period. Excluding the current MARP, Ms. Morganroth has typed nearly one thousand five hundred pages of interdisciplinary material spanning the gamut from Gestalt dialogues to the pure abstraction of symbolic logic structure! Without her energy, ability, and constant encouragement, Confluent Math could never have been developed to the degree of multidisciplinary vastness currently permeating the work.

Mr. Bradley Lawrence, chairperson of the Department of Mathematics at Miami-Dade Community College North, encouraged the creativity of the MARP author, providing him with the classes to test a product that from the perspective of traditional "math" is outrageously controversial. Professors within the Mathematics Department are urged to experiment with innovative curriculum, but the reader who

closely studies Confluent Math (or the summary of the product described in Chapter 3) will quickly realize the potential objections that could be raised on a number of levels. Mr. Lawrence actually enjoyed the most outrageous aspects of Confluent Math, particulary the multi-disciplinary non-ordinary approach to consciousness tied into the Infinity presentation (Unit II), helping the author to establish the future directions of his product described in Chapter 6.

One of the major ideas presented both throughout Confluent Math and the MARP is that mathematics as a creative form has nothing to do with arithmetic computation. The author, allergic to addition, subtraction, multiplication, division, powers, and roots, found his antihistimine (so to speak) through the assistance of Dr. Tien Lin of the Testing-Research Department of Miami-Dade North. Mr. Blitzer submitted data to Dr. Lin along with sheets indicating how the data were to be treated. Dr. Lin translated these directions into computer programs, thereby performing the arithmetic involved with the statistical tests requested by the MARP author. Being liberated from the drudgery of computation, the MARP author continued using his time to develop the creative specifics called for by the original MARP proposal.

The assistance of Mr. Lawrence, Dr. Lin, and particularly Ms. Morganroth cannot be overstated. However a word of acknowledgement must be given to the students in the experimental sections of the current research for being cooperative and open enough to work within a radically different approach, divergent from their initial expectations, to General Education Mathematics.

Abstract of a Major Applied Research Project Presented to Nova University in Partial Fulfillment of the Requirements for the Degree of Doctor of Education.

THE DEVELOPMENT AND EVALUATION OF AN INTERDISCIPLINARY COGNITIVE-AFFECTIVE APPROACH TO GENERAL EDUCATION MATHEMATICS

By

Robert F. Blitzer

May, 1977

The evolving philosophy of general education at Miami-Dade Community College has focused upon the value of general education, values supported by the literature, including courses that provide confluent education (cognitive-affective integration), increased personal awareness and value clarification, along with an interdisciplinary approach to learning. General Education Mathematics at Miami-Dade North is offered as an intellectual survey of a number of isolated units, including sets, algebra, statistics, probability, logic, and systems of numeration. As a general education course, there is a distinct gap between the values of general education and the purely intellectual survey approach used in General Education Mathematics.

The MARP product, designed to bridge this gap, examines various

themes that arise in the creation of pure mathematics, themes that enable the product to ask (with simultaneity): What is mathematics: How does one know? Who am I? Using these general themes (the intellect exclusively used leads toward fragmentation; wholeness is obtained through opposites--polarities providing structural balance; non-attachment to external reality; individual existence before universal essence) the MARP product (Confluent Math: A Multidisciplinary Thinking-Feeling Approach to Twentieth Century Mathematics) guides the participant through uncharted interdisciplinary territory, including mathematical structure, ways of using the mind, Gestalt therapy dialogues, Gestalt dream work, exercises in creativity, infinity and altered states of consciousness, content language and ways in which it molds our perceptions of reality, a language of pure form, role playing, therapeutic computers, etc.

After developing the Confluent Math product, three General Education Mathematics sections at Miami-Dade Community College North were used to implement and evaluate the product. The pre-test and post-test (designed by the MARP author) specifically measured the effectiveness of the three product goals: (1) The participant will understand and appreciate logical axiomatic structure, (2) The participant will examine major philosophic ideas that relate to the creation of axiomatic structure, and (3) The participant will use (1) and (2), in conjunction with affective techniques grounded in the Gestalt therapy theory of Dr. Frederick Perls, to gain increased self-awareness. In addition to measuring changes in these categories,

the pre-test established five general (personality) area preference types, examining before and after results for the entire group (the three classes) as well as the subsets (the area preference types) within the group.

Results, using t-values, indicated with 99 percent certainty an upward shift in mathematical attitudes and understanding the nature of mathematics as an abstract art form. In addition, data indicated with 95 percent certainty that at the conclusion of the course students had acquired additional resources to promote their own self-awareness. These statistical results were reinforced by verbatim responses and by a wealth of awareness assignments based on Gestalt self dialogues, an autobiographical awareness, and Gestalt dream work. These assignments are excerpted in chapter 5 of the present study. Furthermore, changes measured from the pre-test to the post-test were not a function of initial area preference types, with the success of the course-product spanning the gamut of preference types.

Relevant (related to product goal (1)) post-test questions sent to all students passing General Education Mathematics (minimum grade: C) in non-evening "survey" sections indicated that control section students also left the course with positive attitudes toward math. However their attitudes were attached to mathematics as arithmetic computation rather than mathematics as an abstract art form, pointing to a very different perspective toward mathematics on the part of experimental and control groups.

Future plans for the Confluent Math product at Miami-Dade

Community College North include a six credit mathematics-psychology of human potential course, use of the material in the "Mathematics for Elementary Education Majors" sequence, and integration of part of the materials in a "Statistics in Social Research" course.

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CHAPTER 1

REVIEW OF THE LITERATURE

What is mathematics? At the onset it is necessary to give definition to this "useless" art form, particularly so that we can extract various themes that arise in the creation of mathematical structure, relating these themes to innovative directions in the general education curriculum. Our major thesis is that by focusing upon the themes and ideas generated within this twentieth century art form, we can discover interdisciplinary trends among created structures as well as include affective education within what appears to be a strictly rational intellectual framework.

Mathematician P. R. Halmos tells us what mathematicians <u>don't</u> do: - "they have very little to do with numbers...they are not interested in computing machines...they do not determine the heights of mountains by trigonometry or moments of inertia by calculus... mathematics is not physics or science..."[1] For the pure mathematician, mathematics is a logical deductive process, with certain basic rules established at the inception. From these carefully selected sparse set of assumptions (axioms), which need not reflect the external world known through the senses, the mathematician proves new statements (theorems), in turn using these new statements to logically deduce additional theorems. It is in this developmental process that much of the creativity within mathematics lies. Fertile initial rules deductively generate a vast network of relative truths.

The process of proving theorems from a collection of axioms was first established by Enclid with the publication of Elements (approximately 300 B.C.). Euclid set up a deductive system in which a statement (theorem) was shown to be a logical consequence of previous assumptions, although his assumptions were limited to things that could be observed in external reality. (Examples: Between two points one straight line can be drawn. Through a point not on a line exactly one line can be drawn parallel to a given line.) Since Euclid's axioms were formulated from external reality, the content of his theorems related to the real world, reinforcing those things that were known through measurement and observation. For example, Euclid proved that the sum of the angles of a triangle is 180 degrees, although this "fact" was known by the inductive mathematicians who preceded Euclid. It was not the content of the Elements that was so striking, but rather the form or method that Euclid used.

In an attempt to improve Euclid's basic presentation, mathematicians wondered what would happen if some of the axioms were changed. By altering underlying rules, mathematicians have liberated themselves from the mold that a deductive system must be a reflection of physical truth. With interest primarily in logical form rather than specific content of a statement, the mathematical artist relates creative effort to the world of physical reality in much the same way that a novelist's characters are related to real life. The requirements that the characters in a novel be relatively consistent, somewhat unique, and give rise to some sort of plot or conflict, are similar to the requirements the mathematician places upon the rules of a created structure.

Since axioms are statements involving words, underlying a mathematical structure are basic definitions, sometimes stated verbally, at other times presented as formulas or tables. But to attempt to define every word within the axioms would lead to an infinite circular regression of definitions. For example, if the words "number," "unit," and "quantity" appeared in our axioms, and we set up as definitions:

A number is a unit.

A unit is a quantity.

A quantity is a number.

we would have a circular definition--quite common in English, but something to be avoided in a deductive structure. Consequently some words remain undefined, these undefined terms lying at the base of our structure.

Within the parameters of this definition, we can consider the various curriculum processes extant in General Education Mathematics, the "required" terminal course taken by college students who do not need to pursue more specialized mathematics courses. General trends, reflected by current liberal arts mathematics texts, include:

1. The Deductive Abstract Axiomatic Approach

The underlying philosophy to this approach is that in a final exposure to mathematics, the student must deal with the true nature of the subject in a serious, non-trivial way, presenting a few in-depth experiences in mathematical structure and proof. Then one can "step back and discuss what that topic illustrates about the nature of mathematics, what branch of mathematics the topic

belongs to, and perhaps talk about some applications of that branch."[2] The obvious difficulty with this approach is that the level of abstraction inherent in mathematical proof simply leaves many students in a total state of confusion, frustration, and high anxiety.

At the crux of the matter is a most important issue: Is the mind a closed system? -- that is, if one comprehends structure (or idea) A (that idea belongs to, or is closed within the set of all ideas possessed by one's mind) and if one also comprehends structure B, will one necessarily comprehend idea C, where C is built from a synthesis of A and B? Mathematician Cassius Keyser approaches the problem using the group theory axiom of closure under a general mental operation, o, the disjunction of all possible rules for combining mental phenomena.[3] He considers:

$M = \{\text{mental phenomena}\}$.

$A \in M$ (A is a member of M)

$B \in M$

$A \circ B = C$

concluding that C is <u>not necessarily</u> a member of M, or that the mind is incapable of grasping the new idea C. Keyser suggests a correlation between a genius of the so-called universal type (an Aristotle or a Leonardo da Vinci), and the mind that is axiomatically closed, where $C \in M$. Excluding the Aristotle's and da Vinci's, it seems probable that many students in General Education Mathematics would be lost within the territory of abstraction, although this strategy most accurately reflects the nature of mathematics and the

research thought pattern of the mathematician.

2. The Survey Approach

This curriculum process consists of a survey of mathematical structures, presenting major results from each system without the use of deductive proof. Mathematical ideas are presented from the areas of logic, set theory, algebra, probability, statistics, and numeration systems. This is currently the approach used at Miami-Dade Community College North, with the philosophy that basic mathematical literacy in these areas will help one to "develop an appreciation of the role of mathematics in modern life, and, particularly, in your life."[4] Students exposed to this approach leave the course being able to do many things--construct truth tables, solve equations, compute probabilities, write a number in a different base, find mean, median, mode for a set of data, and so on.

The survey approach and the deductive approach need not be mutually exclusive. Within the survey is frequently included a section on the nature of mathematical proof, as well as a sampling of proofs under other topics.

Recently published textbooks include sections on mathematics and art,[5] computer science, graphs and networks, game theory, non-Euclidean geometry, and number theory. Presented under each topic is a potpourri of "interesting" visual results, applications, brain teasers, cartoons, quotes by famous mathematicians, and

problems to be solved.

3. The Basic Skills Approach

In a draft document presented by the General Education Study Committee at Miami-Dade Community College, the Committee addressed the problem of an increasing number of students entering college with severe deficiencies in basic computational skills.[7] In this approach to General Education Mathematics, emphasis is placed upon computational skills that the student might not have achieved in earlier education. Content includes operations with fractions, decimals, percents, consumer applications, and selected topics from algebra and geometry.[8] Unfortunately arithmetic is not the same as mathematics, so that teaching computational skills under a course title of General Education Mathematics establishes the title as a misnomer.

The General Education Study Committee suggests giving students the option to take or not take courses and programs to improve basic skills, "but with the stipulation that the student must demonstrate competency in the skills in order to graduate."[9] At Miami-Dade, the student needing to get assistance to improve weaknesses can do so through work at the Mathematics Lab of The Learning Center or by enrolling in (non-transferable) MAT 101 (College Arithmetic).

It seems unlikely that Miami-Dade will use the basic skills approach within the context of General Education Mathematics (MAT 201).

However, Gill's text (Mathematics and the Liberal Arts) contains a supplementary module entitled "A Review of Computational Arithmetic," a module that can be used by MAT 201 students who study from the audio-tutorial text within the "Open College" program.[4] The survey approach, in an examination of the real number system, frequently includes computations with fractions under a discussion of the rational numbers, although the basic computational skills are presented in passing review, certainly not aimed at the student whose computational deficiencies go back to fundamental operations on the set of natural numbers.

4. The Inductive Approach

In this approach, students generate mathematical results based on actually doing things, making observations and seeking patterns based upon observation. Experiments within the "math lab" often serve as pivoting points for the discovery of these patterns. Harold R. Jacobs made most creative use of this strategy in the best selling Mathematics:A Human Endeavor, using inductive thinking and discovery through experimentation to develop an appreciation of mathematical ideas. Published in 1970, Jacob's sense of humor, the ingenious use of cartoons and photographs, influenced subsequent General Education Mathematics texts, even though many of these texts do not exclusively employ induction as a technique for presenting structural patterns.

5. The Philosophic Approach

Emphasis is placed on underlying philosophic assumptions

about mathematical structure, the evolution of mathematical thought, mathematical creativity, the nature of infinity, abstract axiomatics, the nature of external and internal reality, and ramifications of recent mathematical developments.[10] The student approaches these topics through readings by Plato, Euclid, Bertrand Russell, Lewis Carroll, and other distinguished philosopher-mathematicians, with specific content presented to reinforce a philosophic idea.

Obviously, the five general curriculum approaches discussed thus far are not mutually exclusive, and although a particular practice may verge strongly in one direction, it is certainly possible to integrate the best of all five designs into a single model, drawing from the model those components which best fit the topic at hand. However, if we step back for a moment and view General Education Mathematics as a part of the General Education Program, it becomes necessary to evaluate the five curriculum practices in terms of the basic nature and functions of general education.

Over thirty years ago, the American Council on Education defined general education as "those phases of nonspecialized and non-vocational education that should be the common denominator of educated persons as individuals and as citizens in a free society."[11] Early proponents of general education reacted against curriculum fragmentation, longing for a more holistic unity of knowledge, reacting against overspecialization. Harold Taylor, in 1952, concluded that general education should provide an "orderly and unified system of ideas...unity, integration, and the

development of liberal values," along with the reunion of disparate and unrelated elements of the college curriculum.

Supporters and critics of general education have formulated their arguments around two general motifs. Supporters claim that a broad education with exposure to different (yet integrated) areas of learning creates a well rounded person, grounded in basic knowledge and ready to progress to more specialized areas. Critics focus on career choices, claiming that education should provide students with knowledge that will enable them to succeed on the job, axiomatically following an education = self-improvement = careerism formula that gains increased impetus during a period of economic recession. In this light, general education is viewed as a waste of time, not "helpful" in the pursuit of professionalism.

It is beyond the scope of our background statement to develop either of these positions in great detail. Of greater significance is the larger issue: Why have general education? What is the worth of having this collection of "required" courses, moving beyond the traditional pro and con arguments? We shall outline some of the major values in considering the worth of general education, in turn examining how well the five curriculum processes in General Education Mathematics fit into these statements.

A survey of the literature indicates a number of areas where general education has a unique value. These include:

1. General education enables individuals to develop as feeling-thinking human beings, integrating the feeling emotional aspect

of experience with intellectual functioning. It is a unique area to present confluent education, a synthesis of cognitive knowledge and affective attitudes.[13]

2. General education enables individuals to attain increased awareness of life activities and experiences, clarifying underlying values and integrating these values into responsible decision-making.[14]

3. General education enables individuals to interrelate knowledge from various disciplines, using this knowledge to pursue the goals of daily life.[15]

4. General education provides the impetus for individual commitment to a lifetime of learning.

5. General education enables individuals to appreciate and participate in the creative process.

6. General education enables individuals to acquire the skills necessary to function effectively.

7. General education enables individuals to understand the scientific process, infusing our technological culture and its scientists with more genuine humanness.[16]

8. General education enables individuals to relate more successfully with others, developing skills in working within and with groups.

9. General education enables individuals to develop the values of the post-industrial revolution, including "the experience of joy, the stretching of personal consciousness, the free expression of self."[17]

10. General education enables individuals to understand and appreciate the philosophies, life styles, and accomplishments of individuals and groups throughout history.

On June 25, 1976, the General Education Mathematics faculty at Miami-Dade North met to discuss the draft document issued by the General Education Study Committee. At this meeting, the MARP author presented the above list of values, particularly since these values overlapped with issues brought forth in the draft document. One faculty member asserted, "How can we argue with these? They're like God, motherhood, and country" focusing on value 6 (skills necessary to function effectively) and leading the group into a narrowed down discussion of the basic skills problem. The rest of the meeting centered on a discussion of the student unable to perform basic computations, whether or not to include computational skills within General Education Math, and, if not (group consensus was that these skills did not belong in MAT 201), where to send the student who could not perform basic computations.

It is easy to dismiss the ten value areas as either too general or not applicable to an area that is so deductively rational. After all, how can one study mathematics and simultaneously develop as a feeling human being, or gain increased awareness of one's existence? Aren't such vaguely worded values best left to the "humanities" courses--the less intellectual parts of the general education program--or, better yet, the "soft touchy-feely" affective psychology courses (Human Relations, Gestalt Awareness Seminar, etc.) outside the realm of the general education program? The logical axiomatic content and nature of mathematics

seems to organically exclude many or most of these values. Table I indicates curriculum processes that now address some of these values, with major portions of the table left vacant.

Table I: Values of General Education Reflected In General Education Mathematics

VALUE OF GENERAL EDUCATION	CURRICULUM APPROACH TO GENERAL EDUCATION MATHEMATICS
1. Cognitive-Affective Integration	1. Found in none of the approaches. (At first glance, affective concerns appear to exclude the nature of mathematics.)
2. Increased Personal Awareness and Value Clarification	2. None
3. Interrelationship of Knowledge; An Interdisciplinary Approach to Learning	3. This is present in the philosophic approach, examining the inter-relationship between the creation of mathematical structure and various schools of thought. It is found, to a degree, in all strategies (except basic skills) when considering applications of mathematical discoveries and ideas. (Set theory is related to voting coalitions, matrix theory to business problems, mathematical properties to proportion, order, perspective and symmetry in art, etc.)

4. Impetus For Commitment to A Lifetime of Learning	4. Somewhat difficult to measure. Current texts reflecting all approaches (except basic skills) contain suggestions for further reading, so that a course participant interested in a particular concept can conceivably continue to develop this concept on his/her own. The survey approach at least establishes a foundation for the individual to pursue the development of algebra, probability, statistics, logic, or to take additional courses aimed at addressing these particular areas.
5. Appreciate and Participate in the Creative Process	5. The inductive approach involves participation in the <u>discovery</u> process, allowing the individual to elicit the patterns that exist within created deductive structures. Most of one's time within the other curriculum approaches is taken up learning about what others have created, learning skills, procedures, and concepts that (perhaps) lead to an appreciation of other's creativity devoid of active participation in the creative process.
6. Acquire Skills Necessary to Function Effectively	6. Computational skills along with basic algebraic and geometric concepts are covered in the basic skills approach. The survey and inductive approaches present skills that <u>may</u> be useful

6. (cont'd)	6. to some of the students, such as learning how to compute measures of central tendency covered in a survey of statistics, useful to students within certain fields of study. Many of the "skills" covered (deciding whether a set forms an abelian group under an operation, proving that a statement is a tautology, computing conditional probabilities) go far above and beyond the sorts of things that most people need for effective functioning. The philosophic approach emphasizing ideas generated through the creation of deductive structure least addresses the issue of acquiring skills.
7. Understand the Scientific Process, Infusing Technology with Genuine Humanness	7. This could be an area to consider within the philosophic approach, examining both modes of inquiry, discussing the existential perspective toward technology as well as the difference between science and mathematics as processes for attaining "truth." The survey approach could also consider the topic of statistics within the framework of the scientific process, providing contrasting viewpoints toward the process itself.
8. Enables Individuals to Relate More Successfully with Others.	8. None

9. Enables Individuals to Experience Joy, Stretch Personal Consciousness, Developing Values of the Post-Industrial Revolution.	9. None
10. Enables Individuals to Understand and Appreciate Philosophies, Life Styles and Accomplishments of Individuals and Groups.	10. All curriculum approaches (except possibly basic skills) develop mathematical ideas within an historic framework, hoping to instill in the learner an appreciation for the accomplishments of mathematical creators. J. Bronowski's chapter "The Music of The Spheres" (from The Ascent of Man) beautifully relates mathematical accomplishments to the philosophies and mores of the groups (The Pythagoreans, Mohammedans, Christians) responsible for these breakthroughs.[18]

Where, then, are the major gaps between the values of general education and curriculum processes of General Education Math? Once identified, how can these gaps be filled?

Gap 1. Affective-Cognitive Integration

George Brown suggests the need for curriculum-development projects that move beyond the "overstress on the intellect as the exclusive way of knowing," not ignoring the student as a feeling-thinking human being.[19] Developing this theme, George Leonard writes, "But dropouts and graduates alike have had plenty of practice in fragmenting their lives--segregating senses from emotions from intellect...No need for obscure psychological

explanations for modern man's fragmentation; this is what his schools teach."[20] Leonard goes on to say that "concentration on technical proficiency has become one of the best ways to avoid awareness of self."[21]

The cognitive function of instruction, as defined by Sterling McMurrin, appears to fit the attainment of mathematical knowledge.

> "The cognitive function...is directed to the achievement and communication of knowledge, both the factual knowledge of the sciences and the formal relationships of logic and mathematics--knowledge as both specific data and generalized structure. It is discipline in the ways of knowing, involving perception, the inductive, deductive...processes, and the techniques of analysis and generalization."[22]

The affective function of instruction, on the other hand

> "...pertains to the practical life--to the emotions, the passions, the dispositions, the motives, the moral and aesthetic sensibilities, the capacity for feeling, concern, attachment or detachment, sympathy, empathy, and appreciation."[23]

Examining both functions of learning, Louis J. Rubin reasserts that learning should be holistic. "Encouraging emotionality at the expense of logic, or rationality at the expense of feeling, results either in the subjugation of man to the tyranny of his passions, or in raw intellectualism. In both instances we achieve but half a person."[24]

Psychologist Abraham Maslow uses slightly different terminology to achieve the same sort of integration "so that personal growth can take place through content and skill education and simultaneously with it."[25] Maslow calls content, skill education, "based

on the goals of the teacher, not on the values of the learner" extrinsic learning, contrasting this with intrinsic learning, "learning to be and to become a human being...the learning that accompanies the profound personal experiences in our lives."[26] Maslow agrees that it is difficult to teach many subjects while stressing personal growth and discovery, but like George Brown, feels that it is possible and, indeed, is "one of the pressing tasks for educators."[27] More than anything else, Maslow sees the goal of education as one in which the individual attains self knowledge through the humanization of content education.

Jean Piaget, the renowned "cognitionist" who developed a theory of intellectual development using logical mathematical models, puts the issue in the following way:

> "There is a constant parallel between the affective and intellectual life throughout childhood and adolescence. This statement will seem surprising only if one attempts to dichotomize the life of the mind into emotions and thoughts. But nothing could be more false or more superficial...
>
> "Of course affectivity is always the incentive for actions...since affectivity assigns value to activities and distributes energy to them. But affectivity is nothing without intelligence. Intelligence furnishes affectivity with its means and clarifies its ends...
>
> "Intelligence thus begins neither with knowledge of the self nor of things as such but with knowledge of their interaction, and it is by orienting itself simultaneously toward the two poles of that interaction that intelligence organizes the world by organizing itself."[28]

As we examine current curriculum practices in General Education Mathematics, it becomes clear that potent techniques are needed for confluent affective-cognitive growth. Richard M. Jones

points out the fact that such successful integration is still in its infancy, requiring instructors who are sufficiently sophisticated in the subject matter they teach to relate it to the gamut of human feelings.[29]

Obviously related to this first gap are many of the items listed in Table I, including awareness and value clarification as components of affective learning, the experience of "joy" and "altered" states of consciousness--those "Huxley-ean" (Doors of Perception) non-ordinary direct experiences that perfectly blend under Maslow's definition of intrinsic learning.

Gap 2. Participation In the Creative Process

Philosopher, mathematician, and social critic Bertrand Russell views the creative process in two phases, beginning with the use of insight to inspire a creative idea and developing into a harmonized, controlled structure through intellectual analysis and reason. Just getting an idea without intellectual control and development is to fragment the process, leading one in intuitive, almost mystical directions, certainly not a guarantee of arriving at rationally attained truths.[30]

Abraham Maslow, on the other hand, in viewing the progression from an inspired flash to a final product, believes that we should focus on this first flash and not worry about what becomes of it, even if the idea is "lost" or not acted upon. "The virtues which go with...the creativeness which results in the actual products..,rest as heavily upon other virtues--stubbornness and

patience and hard work and so on--as they do upon the creativeness of the personality."[31]

Learning about another person's mathematical creation, whether as a deductive whole or in extracted results, involves the intellectual hard work--the "stubbornness"--over which Russell and Maslow have divergent perspectives. Regardless of one's point of view, if direct participation in the creative process is seen as a desirable component of humanistic general education, then General Education Mathematics should provide some sort of creative opportunity for the course participant to be actively involved in an intuitive process that simulates the creation of deductive abstraction. Education "must become more interested in the creative process, the creative attitude, the creative person, rather than in the creative product alone,"[32] so that Maslow's assertion would focus attention on both created structure as well as the process involved in such creation, directly involving students in this process.

Once again, there is a need for the development of materials that enable students to trust themselves enough to take risks, to improvise and create beyond the good work habits, discipline and patience involved in comprehending another person's mathematical creation. This does not necessarily mean an inductive approach to generate, via examples and observations, results that are immediately recognizable within a particular deductive framework, but rather to follow a process that reflects the

mathematically creative attitude even if the process does not result in a "mathematical" creation (a theorem generated from assumed axioms). An example of such an exercise, taken from the MARP author's product, is offered to illustrate these statements. The exercise is philosophically grounded on Jean Piaget's observations, "What is interesting about mathematics is that it is the totality of what is possible. And of course the totality of what is possible is the subject's own creation."[33]

SMALL GROUP ACTIVITY INVOLVING CREATION[34] (Each group should consist of between five and eight people, with three to five small groups working on the exercise.)

a. With your group, mentally construct a "thing" that has no known name, shape, color, definition, recognizable form, purpose or utility (for example, it can't be used to "help send rockets to the moon" or "help eat spaghetti more efficiently"). Once your group has mentally designed the "thing":

b. Make a model of the thing on newsprint. (Each group should be supplied with newsprint and magic markers.) Remember that this is only a model--not the real thing, since the real thing exists only in the imagination of the group.

c. Plan a creative presentation--an advertisement of sorts--to "sell" your thing to the entire community (the other groups). Be as outrageous as you want in selling your product, and be sure to include the model of the product that you represented on newsprint. (If the groups want, a panel of judges can present an award for the most creative "thing" and its presentation.)

After the presentations (and award), the following questions can be used for group discussion:

1. In what ways did this exercise resemble the activity of the mathematical artist?

2. How did you personally react--what did you experience--at each phase of the exercise?

3. Did any part of the exercise pervert (for you) the nature of pure artistic creativity?

4. (to the winning group) How do you feel about your creative effort as the group with the prize? (to other groups) How do you now feel about your creative effort even though you were not rewarded?

5. Did you find working with a group a help or a hindrance to your personal creative impulses?

6. In what specific ways has your experience in education stifled your creativity? In what ways has it helped?

7. Is "insanity" a necessary pre-requisite for creativity? How about "suffering"? (Before answering this question, be sure to define the words in quotations.) What are the emotional states in your own existence that lend themselves to your peak creative efforts?

Suggested film: Why Man Creates

8. What is art? What is the difference between "schlock art" (garbage) and good art? Who is in a position to make these sorts of judgments?

9. Have you ever created something you felt good about that other people put down? (Example: writing a paper for a class and getting a low grade.) What did you do? What are some specific instances when you sold out on your creativity to play the survival game?

Gap 3. Interdisciplinary Approach to Learning

George B. Leonard, in Education and Ecstasy, describes "visiting day" to a hypothetical school, 2001 A.D.:[35]

> "The programs still were narrow, concerned with one 'subject' at a time--in other words, they were programs. Then, gradually, they evolved into what we now call 'dialogues.' It started when programmers began adding novelty and surprise through what they at first termed 'extraneous material.' For example, material about astronomy would pop up in programs on Eastern philosophy. Soon, they began realizing that what they were adding was by no means extraneous. Far from it, cross-matrix learning increased the central nervous system's capability for making connections, as well as enhancing mastery of any given subject. The early 1980s were fascinated

> with Cross-Matrix Stimulus and Response (CMSR). Naturally enough, the cross-matrix linkage started out quite teleologically, with the dialoguers seeking 'reasons' for their connections. But 'reasons' were found to be unduly limiting. Random retrieval through a central school computer made it possible to bring material up from the general cultural data bank, from the learner's own past responses and from the discontinuous symbolic storage to create displays that were anything but teleological."

Our definition of interdisciplinary does not involve "zapping" a Fritz Perls' Gestalt dialogue into the middle of an abstract proof (creating, perhaps, a unique artistic form in its own right), or using Jean Piaget's logical mathematical structure as the form common to all natural and human sciences, or talking about fields outside of mathematics which are the recipients of applied structural theorems. What we have in mind are interdisciplinary themes shared by pure mathematics and other disciplines, along with important issues of other disciplines and schools of thought arising as themes within mathematical creation. Our "zaps" will be more purposeful than Leonard's, but will guide the MARP product through uncharted interdisciplinary territory, including mathematical structure, ways of using the mind, Plato's cave analogy, Godel's Theorem and incompleteness of the intellect, Gestalt therapy, Gestalt dream work, existential anguish, original affective exercises, exercises in creativity, mysticism, infinity, altered states of consciousness, Ouspensky's "world of noumena" (Tertium Organum), Carroll's world of nonsense (Alice In Wonderland), content language and perceptions toward reality, language

corruption and political abuse of power, language and sexism, the structure of symbolic logic, logical fallacies in everyday life, prejudices, the structure of algebra, time disorientation, the linear experience of reality, role playing, the inductive method, therapeutic computers, political repression and the computer, viewing one's affective existence within the framework of the mathematical art form--in short, interdisciplinary directions that are uniquely interwoven from the following general themes:

Theme 1. The intellect leads toward fragmentation and incompleteness.

Although calculus, topology, geometry, group theory, are separate in content, the deductive process that leads from the axioms of each structure to the theorems is unified, so that it becomes possible to consider the unification of all deductive structures, the logical form permeating the whole of mathematics. Within mathematical logic, a structure of pure form at the apex of human's abstract intellectual achievement, mathematician Kurt Godel proved that there exist statements which appear to be true (in that there are no individual examples that exhibit their falseness), yet which cannot be proved within a logical structure. Logic, then, is incomplete with the neat theorem non-theorem dichotomy fizzling amid the smoke of uncertainty. William Barrett called Godel's theorem "the collapse of human hubris;"[36] mathematician Hermann Weyl exclaimed, "We have tried to storm Heaven,

and we have only succeeded in piling up the Tower of Babel."[37] For many existentialists and existential therapists, the incompleteness that arises in mathematical logic is characteristic of the incompleteness that any system which exalts reason will generate. True self cannot be encountered by detachment of producing thoughts and ideas.

We suddenly have a theme that lies not only at the core of mathematics, but one that gives rise to a discussion of existential philosophy, the reading of existential poetry, the moving beyond Freudean intellectualizations to the awareness Gestalt model of Fritz Perls, and the even broader issue: If the intellect leads toward incompleteness, then how does one know? How does one attain (relatively) holistic knowledge of external and internal reality?

Andrew Weil argues that our conventional education system teaches that knowing something involves understanding the concept intellectually, rather than experiencing it directly. The intellect is the thought producer of the mind, and thoughts, says Weil, are not realities. It is the discriminating and classifying function of the intellect, the "straight" either-or excluded middle logic that causes us to disown feeling rather than to experience positive and negative multitudinous inner voices as single ambivalent phases of a coherent whole. The intellect, attempting to analyze and understand the negative phase of one's feelings--to strengthen the positive phase and disown that which

is negative--is so busy classifying and "figuring out" that a real awareness of the style of all contradictory personality components, potentially a source of creative energy and a stepping stone for an integrated personality (a whole awareness), is fragmented.[38] Like mathematical logic, one remains perpetually incomplete. Frederick S. Perls calls the intellect the "whore of intelligence--the computer, the fitting game: If this is so, then this is so--all this figuring out by which many people replace seeing and hearing what's going on. Because if you are busy with your computer, your energy goes into thinking, and you don't see and hear anymore."[39]

In addition to the intellect fragmenting awareness, its path toward incompleteness is found in its inability to deal with the experience of infinity. Within the formal operational period of intellectual development, Jean Piaget talks of the intellect's preoccupation with the mechanism of thought, thinking about thinking, thinking about thinking about thinking, ad infinitum,[40] described by Andrew Weil upon taking a too large dose of psilocybin. "I had no way of orienting myself in the ordinary reality in which I could communicate to others. My intellect was so affected that every time it produced a thought, it would automatically think about the thought, think about thinking about the thought, and so on down the tunnel of mirrors. The more I tried to use my intellect to get me out of the expanding confusion, the more dimensions the confusion assumed."[41]

Weil asserts that the concept of infinity is meaningless or incomprehensible to an intellect that deals with finite categorizations, an idea developed within the MARP product in a presentation of the intellectual model for infinity. Mathematical results, echoing the intuitive experiences of the East (the whole is equal to one of its parts; the part emerging from the whole leaves the whole; there is an infinity of infinite numbers; an infinite number is both equal and not equal to itself) removes itself from the direct experience of infinity through the safety of formulas, models, and abstractions--an intellectual form whose content, when experienced, is (according to Weil) at the heart of all panic reactions to drugs--"and, I suspect, to psychosis."[42]

Piaget uses Godel's 1931 theorem, pointing to the limits of intellectual formalization, as a basis for the necessity of an interdisciplinary approach to research. If an incomplete structure can be "finished" through inventing new structures, then this new structure, by logical necessity, will be incomplete, borrowing from other structures or leading to the invention of still higher levels, still fragmented, continuing ad. infinitum in a structural interdisciplinary chain that will remain forever unfinished.[43] The idea is intriguing, although our interdisciplinary approach is to rather relate ideas that most people tend to fragment, particularly through the themes that are common in highly cognitive and highly affective systems. We turn our attention, then, to the second of these themes.

Theme 2. Wholeness comes through opposite forces, ideas, processes, and operations providing structural balance.

The theme of polarities is found in nearly every mathematical art form, from the addition-subtraction dichotomy of simple computation to the derivative-integral operations on functions in calculus, where seemingly separate definitions turn out, through the Fundamental Theorem of Calculus, to be anti-operations, enabling the integral to act as an anti-derivative, providing a counter-change for every invented transformation, a return to the balancing point reminiscent of Greek sophrosyne. The structural $a \circ a' = e$, with a' = inverse and e = identity, is the form not only of group theory but the logical relationship that is established during the concrete operational period of intellectual development (an operation combined with its inverse is annulled), forming the axiomatic foundation for further intellectual development,[44] and the logic behind the human creativity that develops deductive abstract games (i.e., mathematics).

Affectively, we are clearly overlapping with Theme 1. If completeness (or relative completeness on a branch of the structure; we should not forget the Godel's theorem molds the unfinished form of the tree) is attained when "opposites" (opposite operations, mathematically speaking) are considered as two phases of a single structure, components of one's personality which seem to be in conflict may be the energy base--a source of creativity--for an individual. Acceptance of inner ambivalent polar voices, using

affective self-dialogues between masculine-feminine, guilt-resentment, resentment-appreciation, topdog-underdog, hetero-sexual-homosexual, the ambivalences forever reinforcing Whitman's "Do I contradict myself? Very well, then, I contradict myself. I am large, I contain multitudes."[45]--leads to the formation of an integrated personality--what Weil calls "positive neurosis."[46]

In Frederick Perls' holistic conception of reality, the unity and coherent whole of self engaged in the universal self-improvement (= self-torture) game involves the righteous, authoritarian topdog and the pretending-to-be-helpless underdog. "The topdog knows best. He is sometimes right, but always righteous. The topdog is a bully, and works with 'You should' and 'You should not.' The topdog manipulates, with demands and threats of catastrophe, such as, 'If you don't, then--and you won't be loved,...'"[47] At the other pole, "the underdog manipulates with being defensive, apologetic, wheedling, playing the cry-baby, and such. The underdog has no power. The underdog...works like this: 'Manana.' "I try my best.' 'Look, I try again and again: I can't help it if I fail.'...'I have such good intentions.' So you see the underdog is cunning, and usually gets the better of the topdog..."[48] Completeness is attained in <u>experiencing</u> these two polarities--an experience where one gains an awareness of <u>what</u> one is doing and <u>how</u> one does it (one's style) as both self-torturer and self-victim, an organic form that becomes mechanistic and fragmented through intellectual explanation games, with why-because verbiage

producing the excuses needed to keep oneself as a cardboard two-dimensional being.

Perls further develops the wholeness-attained-through-polar-struggle motif in his theory of dreams. An intellectual approach involves dream interpretation via free association, quite different from reliving the dream--acting it out as if it were taking place in the present--directly experiencing dreams as messages about one's existence, with various parts of the dream being fragments of one's personality. Giving each part of the dream a voice (As the object in your dream, describe yourself--your shape, color--what is your purpose for existence?)--playing each part and dialoging among parts, involves a reintegration of fragmented parts of the personality, a "reowning of hidden potential."[52] Perls' entire theory gives specificity to Weil's general discussion of the reality of ambivalence, an umbrella under which appears the nature of mathematical structure, Gestalt therapy, mathematician P. D. Ouspensky's entire description of the Higher World of Noumena (founded on a logical "everything is simultaneously A and not-A" premise[50])--in fact, a universal law of co-existing opposites that thematically spans both the way things really are as well as structural models created to reflect the reality of the way things are. Heinrich Zimmer, an Oriental scholar, has written:

> "...completeness consists in opposites cooperating through conflict...the pattern of existence is woven of antagonistic cooperation, alternations of ascendancy and decline...it is built of bright and dark, day and night--Yang and Yin, in the Chinese formulation."[51]

Theme 3. Non-attachment to external reality.

In describing external reality, or the "real" world to which we attach ourselves through the senses, many statements appear to be true. For example, by looking and measuring, we can "see" that the sum of the angles of a triangle measures 180 degrees. However, as previously mentioned, mathematicians have liberated themselves from the mold that a deductive system must be a reflection of physical truth. With interest in logical form rather than specific content of a statement, mathematical models which provide concrete physical interpretations to pure abstraction can frequently be invented in a multitude of ways, so that

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is only <u>one</u> model for the undefined abstraction called "point," with numerous other models available. The undefined term "statement" of symbolic logic can find physical embodiment as an English sentence or a switch in an electric circuit, where seeing the model and believing it to be the real thing (the abstraction from the inner reality of the mathematical artist) is equivalent to living in the darkness of Plato's cave, believing that the shadows to which one's eyes have become accustomed represent an ultimate reality.

Ironically, traditional education places great stress on the importance of external reality as the <u>only</u> reality, equating reality with external reality in the same way that intellect is

equated with mind. In Carlos Castaneda's The Teachings of Don Juan, Castaneda has an experience with datura inoxia (a drug used in medieval witchcraft ceremonies to trigger nonordinary states of consciousness) in which he soars with extraordinary speed above the head of his teacher, don Juan. Later, conversing with his mentor, Castaneda asks, "'Did I really fly, don Juan?'...'I mean, did my body fly? Did I take off like a bird?'"[52] Castaneda misses the point that in his internal reality, a different order of reality that is self-validating, his experience was real and indeed no less real for being unverifiable in the realm of ordinary experience. Unlike the scientific research method which is based on observation of external reality (a scientific method that Maslow calls "a technique whereby non-creative people can create"[53]), mathematicians create their deductive structure from the same limitless inner reality that gave rise to Castaneda's remarkable fantasy, a sort of inner meditation wherein bottles with no insides, passing through themselves without the existence of a hole (the Klein bottle), nth dimensional space, twisted worlds of one-sided surfaces, noncircular circles, and other limitless axiomatic possibilities arise from withdrawal of attention from our linear perception of external reality. One marvels at the similarity of Bertrand Russell's observation, "It is not open to us, as pure mathematicians or logicians, to mention anything in external reality at all, because, if we do so we introduce something irrelevant..."[54]

and Krishna's (the Hindu analog of Jesus) terse observation, "The tortoise can draw in his legs--The seer can draw in his senses. I call him illumined."[55]

The process of creating (mathematics) involves a recognition of the validity of one's inner reality, a reality where anything is possible except for the limits we choose to place upon ourselves. If the axioms of the mathematician do not come from extraction of things observed, then where do they come from? "Well! I've often seen a cat without a grin,' thought Alice; 'but a grin without a cat! It's the most curious thing I ever saw in all my life!'"[56] Lewis Carroll's inner fantasy--a "grin without a cat"--describes precisely the nature and origin of modern mathematics, creating the necessity for relinquishing usual (natural) language that locks us into this world (external reality) reducing the awareness that serves as a prerequisite for moving beyond the belief that one's sense of external reality is the only reality.

Composer Leonard Bernstein writes of the inner trance state that accompanies creativity, "a condition for contemplating... the conscious mind becomes hazier and hazier, the level of consciousness begins to lower, so that you find yourself somewhere at the borderland of this twilight area...wherein fantasies occur...And if the fantasy happens to be a creative one, if it happens to be taking place in terms of notes, or...in terms of words or design--then I suppose you've hit the ideal state."[57]

Each mathematical theme--the intellect leading toward incompleteness, polarities providing wholeness, the non-attachment to external reality (with implicit recognition of the importance of internal reality and fantasy)--further merges structures that appear to be at far ends of the cognitive-affective continuum. The holistic model, called for by Maslow, Brown, Piaget, Rubin, Weil, Jones, Leonard, Perls in our background statement, is clinched by the fourth and final theme:

Theme 4. Existence Before Essence

Within the parameters of existential philosophy, individual existence takes precedent over universal essence, so that human life is comprehensible only in terms of a particular person's experiences of life--tes[58] choices that carry responsibility for becoming. No universal idea exists for Humans or Humankind, so that the subjective "Who am I?" takes precedent over the objective "What is Humankind?" Individually we encounter true self in the (agonizing) process of freely choosing--building value systems--along with commitment to these choices.

Keeping the same form, changing only the content-nouns, we have:

Within the parameters of mathematical structure, a theorem's existence takes precedent over its universal content essence as absolute truth, so that a theorem is comprehensible only in terms of a particular author's art form--tes chosen axioms that carry responsibility for the theorem's becoming. No universal idea

exists for absolute truth of a theorem, so that the subjective "Is this theorem true relative to the axioms that precede it?" takes precedent over the objective "Is this theorem true?" We encounter true mathematics in the process of freely choosing axioms along with commitment to the theorems generated from this foundation.

And herein lies the confluence proposed by George Brown--viewing one's affective existence within the framework of a rational cognitive structure, using the psychological maxim that behavior is a function of perception. What one does is a reflection of feelings (perceptions) about oneself, one's capacity to love, one's intellectual capacity, value system, feelings about one's body, feelings of worth (or worthlessness), and so on. We can view our behavior (what we do) as the theorems of our existence, with underlying perceptions representing the axioms, definitions, and undefined terms that we have chosen in our self-mathematical model.

An array of affective exercises are suggested. One involves the examination of what one does (the theorems of one's existence) within a deductive structure, with underlying rules, beliefs, shoulds, should nots, perceptions, and values that contribute to or motivate this behavior as the axioms of the behavior, in turn personally defining key words and phrases within the axioms, making the axiom value-statements more specific, reflecting feelings, choices, and personal episodes from the existence of the author. One is as

freely responsible to choose axioms and definitions as Humpty Dumpty is in his assertion, "When I use a word, it means whatever I choose it to mean, neither more nor less."[59] Finally, in fantasy, one can consider new structures by either changing the theorem (behavior statement) to a broader statement--a consideration involving opening new doors and broadening possibilities--in turn changing underlying axioms and definitions to support this new theorem. Or one can broaden the original list of axioms, using these underlying assumptions to generate new behavior-theorems. The second structure involves considering alternatives in fantasy only, reiterating to the author that te is always free to make choices--to accept and reject--so that the most important word in one's vocabulary--"no"--be it "no" to new experiences, people, values, life-axioms, ideas--define the boundaries of one's chosen existence.

As one creates the two structures, the first describing present behavior in a particular area, and the second, alternatives to the present behavior, numerous questions arise for consideration:

1. What would your new life be like with the second list?
2. What is the payoff (for you) of the first list: (In other words, what do you get from living your life within the first structure?)
3. What are your objections to your second list? What would you lose if you were to live your life in this fashion?
4. What do you lose by living your life by the first structure?
5. What might you gain if you were to live your life by the second structure?
6. Where did the axioms of your first list come from? Did somebody teach them to you? (Consider each axiom separately.)
7. How do you <u>feel</u> (what do you experience) reading through the first list? the second list?
8. How would people close to you--parents, friends, lovers,

teachers--react if they were to read your two lists? (Keep in mind that this is your fantasy of how you think they would react.)

9. Even within this one limited area, does the framework of an intellectual axiomatic structure capture the essence of your existence? Do you experience a sense of completeness with the structure? If not, are there other more effective techniques that you could develop that would enable you to do some work within the area of your original "theorem?"

Possible also are Gestalt dialogues between conflicting components of the two structures, as well as using the self-axiomatic technique as a means for value development and clarification in the areas of human relationships, "love," human sexuality, relationship with work habits directly tied in with the role of student--the list seems endless! Reiterated by Sidney B. Simon in Values Clarification, "Everything we do, every decision we make and course of action we take [theorems], is based on our consciously or unconsciously held beliefs, attitudes and values [axioms]."[60]

Using fantasy as a technique to explore, expand, and consider alternate value structures can be a powerful form of self therapy. Writing of this technique after using the second axiomatic model to explore the possibility of homosexual expression of his sexuality, a student asserted, "After doing this assignment I learned a lot more about myself than I ever thought I would. I enjoyed the first part of the assignment a lot, but I think I got more out of the second part. In the first part I wrote really what has been on my mind lately and what happens to be one of the most confusing issues in my life. Then I started on the second part...

> I realize now that there is a lot more to life than I know and the more and more I experience or should I say let myself experience will make me a more rounded person...I felt as I was writing the second list saying to myself holy shit am I writing that...I honestly believe that there was somebody else writing the second part but I do assure you I was moving the pen. It was really a strange experience for me."[61] Indeed, the technique has been extremely powerful for repressed inner voices to find eloquent expression in a (second) structure usually reserved for the brilliantly created abstraction of the mathematician.

It is our attempt to integrate the affective and cognitive, to investigate mathematical themes in seemingly dissimilar disciplines, to bring the noblest aims of humanistic general education (as expounded by The General Education Study Committee at Miami-Dade Community College) into the teaching of General Education Mathematics in the most specific of ways:--in essence, to create a collage of sorts, asking with simultaneity--What is mathematics? How does one know? Who am I?-- that leads to the statement of our problem.

The problems investigated throughout the MARP were: (1) to create an interdisciplinary General Education Mathematics course, wherein mathematics as an abstract art form (along with the themes that underlie this art form) is considered in relation to both philosophy (and the general question: How does one know?) and the psychology of human potential (and the general question: Who am I?), (2) to develop in the learner a positive attitude toward the

philosophy of mathematical creativity, and (3) to enable the learner to gain increased self-awareness through the use of awareness techniques grounded in the Gestalt therapy theory of Dr. Frederick Perls, techniques whose themes parallel those of mathematical axiomatics.

CHAPTER 2

PROCEDURES AND METHODOLOGY

In the preceding chapter we suggested various issues in an attempt to make General Education compatible with the values of humanistic education. The MARP product (Confluent Math: A Multi-disciplinary Thinking-Feeling Approach to Twentieth Century Mathematics) was created in order to address the issues of cognitive affective integration and interdisciplinary themes pointing to the interrelationship of knowledge, while preserving a quality approach to the true nature of mathematics as an art form. Confluent Math, employing a holistic approach, is directed at all facets of the student's humanity, including using the intellect to understand abstraction, using intuition and fantasy as a corequisite (or prerequisite) to creativity, exploring one's inner reality--in general, asking three questions for which one must turn to different components of self for answers: How does one know? What is mathematics? Who am I?

Chapter 3 contains a detailed description of the MARP product, a sample of unusual exercises contained within the product, and a discussion of how the product specifically addresses values of general education now ignored by existing curriculum trends in General Education Mathematics. The present chapter represents the research design used to evaluate Confluent Math, a work reflecting the integration of the MARP author's unique educational background, including a master's

degree in pure mathematics, training in Gestalt therapy and psychodrama techniques, numerous psychology courses taken at both the undergraduate and graduate levels, facilitating groups in Gestalt awareness and male consciousness-raising, intellectual and intuitive work on the mathematical nature of infinity with ramifications for expanding ordinary consciousness, as well as extensive reading in the areas of mathematical philosophy and humanistic psychology.

The description of the MARP research design should thus be considered in relationship to the unique values of general education developed within the MARP product along with the general goals of the product. In summary, these values include:

1. General education should enable individuals to develop as thinking-feeling human beings, integrating emotions, passions, and intuition with intellectual functioning.

2. General education should provide a multidisciplinary approach to learning, interrelating knowledge from various disciplines.

3. General education should provide specific tools and techniques for the individual to learn more about tirself. These techniques should be aimed toward increased awareness of one's activities and experiences, examining and clarifying underlying values, and becoming more responsible for one's own existence.

The major goals of Confluent Math, providing the shape and focus for the MARP research design, include:

1. (Mathematics) The participant will understand and appreciate logical axiomatic structure (mathematics as an art form).

2. (Philosophy--Ways of Knowing) Since mathematics represents one mode of inquiry, the participant will examine philosophic ideas related to the axiomatic way of knowing along with the broader question--How does one know? The user of Confluent Math will consider answers to this question from the perspective of mathematicians, Western philosophers, Eastern philosophers, mystics, logicians, psychologists, scientists, humanists, artists, educators, poets, and linguists.

3. (The Psychology of Human Potential) The participant will use (1) and (2), in conjunction with techniques grounded in the Gestalt therapy model of Dr. Frederick Perls, to gain increased awareness of tes existence.

The procedures used in the MARP design were:

I. The product, Confluent Math: A Multidisciplinary Thinking-Feeling Approach To Twentieth Century Mathematics) was created by the MARP author (see Chapter 3).

II. MAT 201 (General Education Mathematics) is a one term three credit (usually second year level) course in mathematics at Miami-Dade Community College, Miami, Florida. The population for the present study included students at Miami-Dade Community College North Campus who satisfied their three credit math requirement with MAT 201 during the Fall term of the 1976-77 academic year. This population is not a cross-section of the Miami-Dade North student body, since students whose major requires a specific content course in mathematics (such as trigonometry) would

not elect MAT 201.

From the ten sections of MAT 201 offered at Miami-Dade North during the Fall 1976-77 academic year, three sections of the course were offered by the MARP author using his Confluent Math product. Unlike many math courses taught at Miami-Dade, there is a great deal of flexibility in both content and approach in MAT 201. Indeed, three different textbooks are being used in the course, chosen by individual instructors. Although the approach of Confluent Math represents a more radical departure from that employed by all three texts, students in the sample (three sections) were not specially selected from the population, winding up in the experimental sections through random scheduling.

III. At the onset of MAT 201, students in the experimental sections were given a pre-test (see Appendix A) designed by the MARP author. The pre-test covered four general categories, including:

Category A: Math Attitudes

Category B: Understanding the Nature of Mathematics as an Abstract Art Form

Category C: Having Resources Available to Promote Self-Growth and Self-Awareness

Category D: Attitudes Toward School

The pre-test also measured areas of interest that each student preferred, with the establishment of five area preference types. Details concerning the content of this pre-test and the way the data from the pre-test were handled are described under V.

IV. Students in the experimental sections, after taking the pre-test, were told about the underlying philosophy toward general education that shaped the direction of the course they were about to take. Students who felt uncomfortable with the confluent multidisciplinary approach were given the option of switching to a different section. It was suggested that students who needed work in basic computational skills (arithmetic) enroll in MAT 101 (Arithmetic) rather than General Education Mathematics. It was also pointed out that students who experienced problems in reading ability would be bewildered at the sophisticated verbal level used throughout the selections in Confluent Math. Students were also informed that General Education Mathematics is not intended to be a course in consumer arithmetic or a course to develop particular skills related to vocational aspirations.

V. Data collected from the experimental sections on the pre-test were used as one means to evaluate the Confluent Math product. In order to understand how this was done, it is necessary to consider the 29-item pre-test in some detail.

The pre-test (see Appendix A) consists of two parts. Each of the twenty three questions in Part 1 relates to one of four general categories designated by:

*	for Category A:	Math Attitudes
**	for Category B:	Understanding the Nature of Mathematics as an Abstract Art Form
***	for Category C:	Having Resources Available to Promote Self-Awareness
****	for Category D:	Attitudes Toward School

(Of course, these starred designations did not appear on the student copy of the pre-test.)

Each item was scored from 1 to 5, with a high score representing:

a positive attitude toward math within Category A

an understanding of the nature of mathematics within Category B

the availability of resources to facilitate self-awareness within Category C

a positive attitude toward school within Category D

Items underlined in Table II represent those in which the scoring was reversed.

Table II: Items on the Pre-Test Broken Down By Category

CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY D
1, 4, 6, 15, 21, 22	2, 5, 8, 11, 16, 19	3, 13, 14, 20	7, 9, 10, 17, 18, 23

For each of the four categories the mean, standard deviation, and internal reliability (using Cronbach's coefficient alpha) were determined. Also computed was an inter-item correlation matrix, seeking significant correlations of items at both the 5 percent and 1 percent level of significance within each category. These computations were then repeated for the overall (part 1) pre-test.

Questions 1 through 6 in part 2 of the pre-test were designated to establish five general area preference types, defined by:

Type 1 ("I know, therefore I am"): These people are interested in the inner world of knowledge, ideas, and concepts, even if this knowledge can be put to no immediate or practical use.

Type II ("I feel, therefore I am"): These people are interested primarily in the affective domain, emphasizing their feelings as well as the feelings of others. Self-knowledge is extremely important to type II people.

Type III ("I can deal successfully with and manipulate practical things in the real world, therefore I am"): These people are interested primarily in dealing with things that exist in external reality in a very practical way.

Type IV ("I can manipulate and control numbers effectively, therefore I am"): These people are quite interested in dealing with numbers, arithmetic manipulations, finances, etc.

Type V ("I can work to bring about change in the social/political/economic structure, therefore I am"): These people are concerned with working to change perceived injustices within the system.

These five area preference types, although constructed by the MARP author, were indirectly suggested by questions appearing on the "Learning Styles Inventory" developed by Albert A. Canfield, Ph.D. and J. Clayton Lafferty, Ph.D.

Most of the items in questions 1 through 6, part 2, are directly related to one of these area preference types, as indicated in Table III.

Table III: Part 2 Questions on the Pre-Test Broken Down Into the Five Area Preference Types

	AREA PREFERENCE TYPES				
	I	II	III	IV	V
PART OF EACH QUESTION	1c	1a	1d	--	1e
	2d	2e	2c	2a	2b
	3b	3d	3a	3e	3c
	4d	4b	4e	4c	4a
	5a	5c	5b	--	--
	6e	6d	6c	6a	6b

On each student pre-test, every ranking was assigned a point value according to:

RANKING	POINTS
1 --------	5 points
2 --------	4 points
3 --------	3 points
4 --------	2 points
5 --------	1 point

Points were assigned to the area preference type according to Table III.

Consider, for example, a respondent who ranked question 1 in part 2 by:

1. a 2
   b 4
   c 1
   d 5
   e 3

Using Table III (first row for question 1) and the points assigned to each of the five rankings, we have:

1. a 2 ----- 4 points assigned to II

   b 4 ----- 2 points NOT ASSIGNED (1b does not appear in Table III)

   c 1 ----- 5 points assigned to I

   d 5 ----- 1 point assigned to III

   e 3 ----- 3 points assigned to V

Using this scheme, maximum points assigned to each area preference type are:

Type I 30 points

Type II 30 points

Type III 35 points

Type IV 20 points

Type V 25 points

Each student who took the pre-test was assigned a primary area preference type according to the following scheme:

Table IV: Assignment of Area Preference Types

TYPE TO BE ASSIGNED	NUMBER OF POINTS IN ORDER TO RECEIVE THE ASSIGNMENT
I	22 - 30
II	22 - 30
III	22 - 35
IV	14 - 20
V	18 - 25

VI. One of the purposes of the Confluent Math product was to enable the learner to gain increased self-awareness through the use of Gestalt awareness techniques whose structural themes parallel those of mathematical axiomatics. In relationship to this area, course participants in the experimental sections of MAT 201 were required to work on two self-awareness exercises throughout the duration of the course, including:

"Your Life as a Mathematical Structure" and one of

"A Dream Journal"

"An Autobiographical Awareness"

"Three Gestalt Dialogues"

"An Integration of the Three Areas Mentioned Above"

These exercises were designed by the MARP author and appear in both his Confluent Math product as well as in chapter 3 of this MARP.

The student awareness exercises were arranged in terms of the general issues and themes that students explored in the "Who am I?" portion of the course. The Confluent Math author synthesized the responses to these awareness assignments along the lines of these general themes, particularly in relationship to the topdog-underdog self torture game of Gestalt and the function of dreams. A sample of student awareness assignments illustrating the general issues that appeared most frequently in these projects is presented in chapter 5.

VII. Copies of the MARP product, Confluent Math, were made available to MAT 201 instructors at Miami-Dade North, selected members of Miami-Dade's General Education Task Force, selected members of a committee

at Miami-Dade North studying competency based education (this committee is interested in establishing interdisciplinary courses centered around "ways of knowing"), and selected faculty at Miami-Dade North teaching psychology, English, and philosophy. In addition, a copy was made available at the Miami-Dade North Learning Resource Center. The existence of this copy, along with a description of the philosophy behind Confluent Math, was publicized to the North Dade faculty and administration in the February 1977 edition of the Campus newsletter.

The MARP product was sent out in four installments, with a synopsis of the readings and the philosophy that shaped their direction. All persons receiving Confluent Math were encouraged to give the author their reactions to the package. It was made known that the author was seriously considering a six to nine credit interdisciplinary course, along the lines of "Mathematics and Ways of Knowing," based on these materials to be taught during the Fall 1977-1978 term.

VIII. On the final day of the Fall 1976-1977 term, after all work had been turned in and the last examination returned, the three experimental sections of MAT 201 using the Confluent Math materials were given a post-test.

The post-test, appearing in Appendix B, has a part 1 identical to that of the pre-test, with verb tense changed where appropriate. In addition the post-test contains a second open-ended section dealing with course-product evaluation.

A t-value was tabulated for each of the 23 items appearing on both pre-test and post-test. A t-test was also performed for each of the

four categories (categories A through D described under procedure V).

An analysis of variance was conducted for post-test mean scores for each of the categories A, B, C, and D for five subsets of the experimental group (area preference types I through V), seeking significant attitudinal differences among the area preference types on one or more of the categories.

The open-ended responses given in part 2 of the post-test were arranged by area preference type. Within each area preference type, similar responses and themes were collected by the MARP author. These responses were then considered in relationship to the stated goals of the Confluent Math product course.

IX. Eighty copies of the instrument appearing in Appendix C were mailed two weeks after the conclusion of the Fall 1976-1977 term. The instrument was sent to all Miami-Dade North students who had completed (minimum grade: C) MAT 201 during the Fall semester in daytime sections other than the MARP author's. As previously mentioned, of the ten available sections of MAT 201, three were taught by the MARP author. With two evening sections, there were five available classes to use as a control group.

The instrument sent to students receiving a grade of C or higher in these five sections contained questions identical to those in categories A and B of the pre and post-test administered to students in the MARP author's three experimental sections. Categories A and B (math attitudes; understanding the nature of mathematics as an abstract art

form) were compared with the results of the experimental groups on the post-test. A t-value, seeking significant differences between group means, was computed for each of the two categories as well as for the individual questions that identically appear on the post-test to the experimental group and the instrument sent to the control groups.

The entire procedure discussed thus far appears in Figure I on the following page. Results elicited from the procedure are presented and discussed in chapters 4 and 5.

The following terms are crucial to the basic MARP design. Although they were previously discussed, they are summarized below in order to give the reader a better feeling for the totality of the design.

DEFINITION OF TERMS

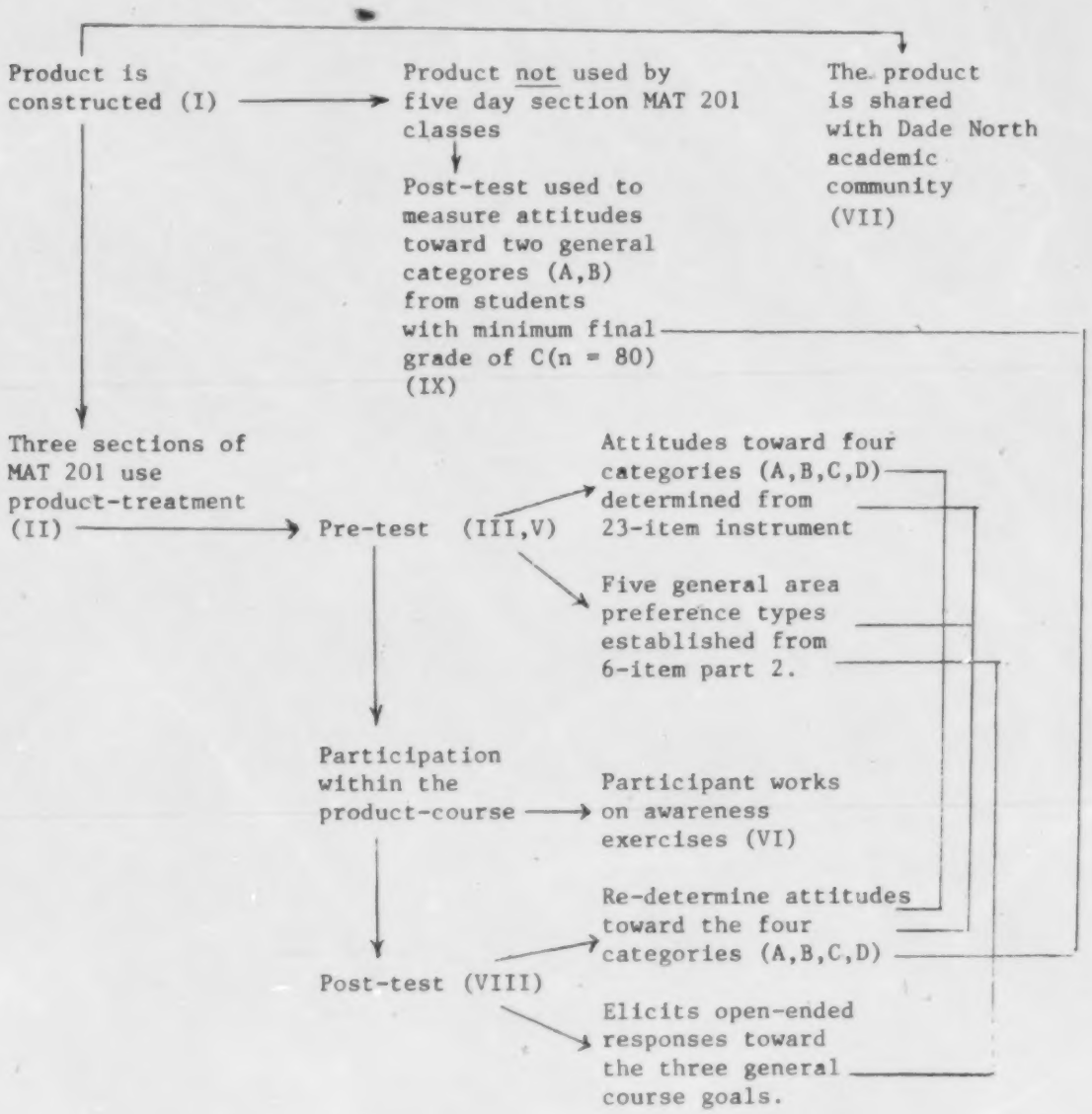
Area Preference types: The pre-test establishes one of five general area preference types for each student, according to:

Type I	-	I know, therefore I am.
Type II	-	I feel, therefore I am.
Type III	-	I can deal successfully with and manipulate practical things in the real world, therefore I am.
Type IV	-	I can manipulate and control numbers effectively, therefore, I am.
Type V	-	I can work to bring about change in the social/political/economic structure, therefore I am.

Categories A, B, C, D: Each of the twenty-three questions appearing on part 1 of both the pre-test and post-test measure four categories, with every question classified as:

Category A:	Math Attitudes
Category B:	Understanding the Nature of Mathematics as an Abstract Art form

Figure 1. The Flow of the Basic MARP Design (Roman numerals refer to the steps presented in chapter 2.)


Product is constructed (I)
Product not used by five day section MAT 201 classes
Post-test used to measure attitudes toward two general categores (A,B) from students with minimum final grade of C(n = 80) (IX)
The product is shared with Dade North academic community (VII)
Three sections of MAT 201 use product-treatment (II)
Pre-test (III,V)
Attitudes toward four categories (A,B,C,D) determined from 23-item instrument
Five general area preference types established from 6-item part 2.
Participation within the product-course
Participant works on awareness exercises (VI)
Re-determine attitudes toward the four categories (A,B,C,D)
Post-test (VIII)
Elicits open-ended responses toward the three general course goals.

Category C: Having Resources Available To Promote Self-Growth and Self-Awareness

Category D: Attitudes Toward School

Mathematics (or "Mathology" or "Mathematical Art Form"): A deductive process in which relative truths are proved from an arbitrarily created framework of undefined terms, axioms, and definitions.

MAT 201: General Education Mathematics, a one term three credit (usually second year level) course in Mathematics at Miami-Dade Community College, Miami, Florida.

Population of the Study: The students at Miami-Dade North who satisfied their three credit math requirement with MAT 201 during the Fall term of the 1976-1977 academic year.

Sample of the Study: Three classes of MAT 201 students.

Self-Awareness: Awareness of (a) what one is experiencing in one's body (what one is feeling) or (b) what one is thinking or fantasizing (one's inner reality) or (c) what one senses (sees, hears, touches, tastes, etc.) in the outside world (sense attachment to external reality).

Variables of the Study: Independent variables are (1) the MARP product and (2) the course instructor. Dependent variables, related to categories A,B,C,D (defined above) are (1) attitudes toward mathematics, (2) an understanding of the nature of mathematics as an abstract art form, (3) having resources available to promote self-growth and self-awareness, (4) attitudes toward school.

The entire research design was aimed at testing the following alternate hypotheses:

1. The MARP product, emphasizing the mathematical art form within an interdisciplinary framework, will lead to a more positive attitude toward mathematics on the part of the learner. This change will be most pronounced for area preference types I and II and least pronounced for types III and IV.

2. The participant using the MARP product will experience an increased understanding of the nature of mathematics as an abstract art form.

3. The participant using the MARP product will gain increased resources in order to promote self-growth and self-awareness. This will be most pronounced for area preference type II.

4. The 29-item pre-test will be quite reliable, with coefficient alpha for each category as well as the overall instrument reflecting the high internal reliability.

5. Many significant correlations will exist between the items on the pre-test. Positive correlations will also be high between categories A and B, and categories A and D.

6. Attitudes toward mathematics and an understanding of the nature of mathematics as an abstract art form will be significantly higher in the groups using the MARP product than those receiving the usual treatment.

Finally, we consider the basic limitations and delimitations of the procedure, along with those basic assumptions that shaped Confluent Math and its evaluation. These special statements will be of significance when considering future directions of the MARP product in chapter 6.

LIMITATIONS

1. The major purpose of the MARP involved product development and evaluation. With emphasis on development, implementation, and evaluation of effectiveness, format designs involving control groups taught by the MARP author were not considered appropriate as this would have put the author in the position of using an approach that he obviously believed had less value than that of his product, a bias that would affect the level of enthusiasm he brought to the control section(s). Furthermore, with a limited number of sections of MAT 201 available to the MARP author, employing control groups that he would teach would seriously cut into the number of experimental groups available to him, in contradiction to his fundamental purpose.

2. To work partly around limitation 1, a procedure for data collection was introduced that involved use of control groups not taught by the MARP author. Dependent variables of the MARP were a function of two independent variables, the Confluent Math product and the course instructor. Since the latter is not being controlled and since, in all candor, the MARP author has the reputation of being one of the better instructors at Miami-Dade North, this limitation must be taken into consideration when considering results that are hypothesized to be statistically significant. This limitation becomes somewhat less potent, however, when realizing that the random sample of MAT 201 students in the control group spans a number of different instructors, some with equally outstanding classroom skills as the MARP author.

3. As previously mentioned, the product represents an integration of Mr. Blitzer's unique educational background, a background not shared by many mathematics majors. For this reason, the entire product contains much information that may be educationally foreign to math instructors schooled minimally in the humanities and perhaps not familiar with areas such as non-intellectual approaches to self-awareness or the philosophy of mathematical creativity. The MARP author believes that much material in his product would be foreign to the style, tastes, and approach of many math instructors, although there is much that could enrich even a conventional approach to General Education Mathematics if the product is used in part.

4. The product was tested only at Miami-Dade North. The Nova National Lecturer in curriculum development presented statistics indicating that urban community college students rank "knowledge and skills directly applicable to their careers" as the most important thing that a junior college should help them acquire, implying that general education be intimately concerned with action, keeping the workaday world within its vision. Although urban community college students ranked "a broad general education" as the second most important thing a junior college should help them acquire, the MARP product may be more successful at a four-year liberal arts college than at a community college. Consequently, final data interpretation, even if results are not significant, will not include a population (four-year liberal arts students) that might respond more favorably to the MARP product than community college students.

It should be pointed out, however, that despite the career issue, the MARP product is in complete accord with the philosophy of general education evolving at Miami-Dade, leading one to wonder how this philosophy contains ideas unique to community college education. The General Education Study Committee has stressed that it is a mistake to equate college education with career preparation, but as one reads their document or the Confluent Math product, it seems evident that the tone and content would be more appealing to the four-year student whose program is grounded in the liberal arts than a student under financial stress attending a two year primarily vocational program (mortuary science, fashion

modeling, air conditioning technology, etc.) in order to find a better paying job as quickly as possible.

DELIMITATIONS

1. The study included only Miami-Dade North students enrolled in General Education Mathematics (MAT 201). Limitations of not including students at a four-year liberal arts college enrolled in General Education Mathematics were discussed above.

2. Within the product, the nature of mathematical art was given the most specificity by a thorough development of the symbolic logic structure. Other structures could be developed, but the MARP author chose to include this axiomatic game because (1) it does not require previous mathematical background on the part of the course participants, (2) by the unique way the author developed the topic, a fairly complete structure (with a sense of wholeness rather than an isolated fragment) reflected the themes discussed in the first unit of the product, and (3) the natural language of English can serve as an external reality model of the structure, making it easier for the observer of the art form to bridge the gap between abstraction and the "real world."

3. The product included only materials that further developed the general themes of the initial unit on mathematical philosophy. The product did not include mathematical procedures extracted from particular structures that are explained as ends in and of themselves. For example, a section on the straight line showing

the learner how to write the equation of a line passing through two given points (extracted from analytic geometry structure) was not included in the product, since such a "how to" presentation would do little more than to present a procedure bearing no relationship to the philosophic ideas underlying the creation of mathematical axiomatics. Similarly, topics, puzzles, word problems, etc., that did not directly relate to the ideas of the first two units were not included in the MARP product.

BASIC ASSUMPTIONS

1. Students coming to General Education Mathematics have little idea of what twentieth century mathematics as a logical art form is all about. Based on the MARP author's experiences teaching mathematics, most people believe mathematics to be equivalent to arithmetic computation, or algebra "with letters instead of numbers," or a body of applied knowledge that is used by science in order to achieve technological accomplishments in the real world. Mathematics, in its themes as a purely logical deductive structure, is related more to philosophy and ideas permeating humanistic psychology than it is to science or computational skills.

2. Most students taking General Education Mathematics would not study the course if three credits of mathematics was not a requirement. The MARP author initially asks all general education students, "How many of you wouldn't be here if you didn't have to?" with a response never less than sixty percent of those present.

3. Since mathematics is an art form whose themes span a number of other disciplines, General Education Mathematics should be more than an isolated survey of rationally presented areas (algebra, logic, statistics, probability, etc.) that exclude aesthetics, non-intellectual ways of gaining self-knowledge,and ways of knowing other than cognitive rationality.

4. Awareness of oneself as one is right now is more important than trying to change oneself or improve oneself, which involves interfering with and distorting one's functioning. This position, supported by the review of the literature in chapter 1, carries the basic assumption that education should give each individual various tools by which te can become more aware of tes reality (existence, humanness) and the underlying value system that supports this existence.

CHAPTER 3

DESCRIPTION OF THE MARP PRODUCT

The purpose of this chapter is to present an overview of the contents of Confluent Math: A Multidisciplinary Thinking-Feeling Approach to Twentieth Century Mathematics. We shall include a general description of the five units making up the product, a description of each of the readings within the units, a sample of unusual exercises at the conclusion of the readings, a list of general topics covered in the product, and a discussion of specific ways the product addresses the values of general education surveyed in Chapter 1.

Because of the enormous size of Confluent Math, it was decided to include limited copies of the product as a document distinct from the MARP. Hopefully the present chapter will enable the reader to examine the totality of Confluent Math without the hundreds of hours required to study the original product. However the product is on file at both Nova University and with Dr. John Roueche of the University of Texas so that the reader intrigued with parts of the present description can examine the original source in greater detail. Furthermore, any article written by the MARP author or any of the exercise sets he created for the selections can be obtained by writing him at Miami-Dade Community College, North, the Mathematics Department.

Confluent Math is divided into five major units, with each unit organized around readings and exercises following a particular article.

Although Mr. Blitzer authored the major portion of the readings, other authors are represented throughout the product. The exercises at the end of each selection were created by the MARP author whether or not he actually wrote the selection.

Unit I, Introduction to Mathematics, moves from a theory of consciousness (The Natural Mind) which places increased importance on the validity of one's internal reality, limitations of the intellect, the importance of ambivalence, and the encounter with infinity to a definition of the nature of twentieth century mathematics ("The Mathematical Art Form"). The themes of a different level of consciousness are integrated into our definition of mathematics, reappearing in an examination of existential philosophy and the incompleteness of mathematics ("Your Life as a Mathematical Structure"). An historic satiric journey gives the inventor of the mathematical form a hard time for his major gaffe in the structure called geometry ("Euclid and the Bright Boy"). Finally, mathematician, philosopher, and social critic Bertrand Russell gives us his point of view regarding how one can attain true philosophic knowledge ("Mysticism and Logic"), emphasizing a pro-intellectual perspective to knowing the nature of mathematics as a philosophic system.

Readings within the unit include: Weil, Andrew.(selections from) The Natural Mind[62]

Andrew Weil, a Harvard-educated doctor of medicine, raises the question: How does one know? Dr. Weil argues that traditional education stresses the intellect as the exclusive mode of acquiring knowledge,

pointing out that most of this knowledge is obtained by inductively generating hypotheses based on observing external reality. A case is made for knowledge acquired through intuition with emphasis on one's internal reality. Weil's discussion of internal-external reality, intuition-intellect, the reality of ambivalence (wholeness, states Weil, is obtained through the cooperation of opposites working through conflict), and infinity form general themes around which much of Confluent Math is developed.

At the conclusion of The Natural Mind the MARP author presents an array of exercises generated by Weil's ideas. One of the exercises deals with considering the notion of ambivalence on a personal level, an exercise that is later developed into Gestalt dialogues. This self-awareness experience is reproduced below.

Excerpted Exercise: Becoming Aware of Ambivalence (Polarities)

The idea of wholeness attained through opposite forces, ideas, processes, and operations providing structural balance is found in numerous disciplines. We shall see that in nearly every mathematical art form, from the addition-sub-raction dichotomy of simple computation to the derivative-integral operations on functions in calculus, counter-changes appear for every invented transformation. The purpose of this exercise is not to explore opposite operations in mathematics, but to give you the opportunity to explore sides of yourself.

Our language is filled with some frightening labels for those persons who are aware of Dr. Jekyll-Mr. Hyde polarities within themselves ("crazy" "schizophrenic"). Walt Whitman, not bothered by inner ambivalences, affirmed:

"Do I contradict myself?
Very well then I contradict myself.
I am large
I contain multitudes."[45]

In order to attain wholeness, rather than to deny "negative" feelings we can become aware how a multitude of seemingly contradictory feelings are part of our entire life script--the existence that we author for ourselves. The requirement that everything "be nice" all the time serves to help us disown certain feelings, struggling to bury or deny them since they cause discomfort. A tremendous amount of energy is often consumed in the process of denial, energy that for some persons begins to interfere with everyday functioning. As a society of drug abusers the gamut of drugs from alcohol to tranquilizers serve, in a "straight" manner, as numbing agents for negative feelings. The problem is not ambivalence since contradictions permeate our existence, but rather the way we deal with these contradictions. Viewed from the either-or perspective of straight consciousness, it becomes quite easy to conclude "therefore I'm sick," a perspective reinforced by many traditional therapists. Another point of view, after gaining an awareness of inner polarities, is the conclusion "therefore I'm human--my inner wholeness enables me to view the external world in a whole and complete manner." Or, as Walt Whitman put it:

> "I swear the earth shall surely be
> complete to him or her who shall be complete
> The earth remains jagged and broken to
> him or her who remains jagged and broken."[63]

In each of the following items, various polarities are presented. For each polarity (ambivalence):

1. Consider first the right end of the continuum, writing as many short and specific statements about yourself that support that particular word or phrase. Consider things that you do to illustrate that phrase, things that you might like to do that are related to that phrase, feelings that you have that relate to the category, or fantasies that you have that support a particular characteristic. If you do not relate to the phrase on any level (your external reality existence, unexpressed feelings, fantasy, etc.), say so.

2. Repeat this process for the word or phrase at the left end of the continuum.

3. Place an "x" on a spot on the "ambivalence line" that represents a comfortable integrated position for you. On certain items, this may be right in the middle, closer to the right or left end, or possibly directly at one of the extremes.

4. Repeat steps (1) through (3) for as many items that capture real conflict, ambivalence, contradictions for you. If you feel that a particular item does not relate to your existence, skip it and move on to the next.

a. Feminine — Masculine

b. Intuitive — Logical

c. Dependent — Independent

d. Completely dependent on my family — Completely indifferent to my family

e. Introverted — Extroverted

f. Lazy — Productive

g. I disklike myself — I like myself

h. Inferior — Superior

i. Governed by emotion — Governed by reason

j. Submissive (passive) — Dominant (active)

k. Soft-vulnerable — Hard-aggressive

l. Conformist — Rebel

m. Angry — Loving

n. Defensive & apologetic — Righteous & Authoritarian

o.

I resent _____ (this should be the same person you feel guilty toward)

I feel guilty toward _____ (Name of person)

p.

I blame other people for what's happened to me.

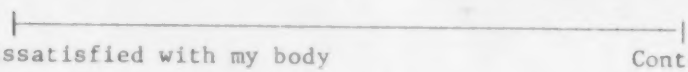
I am responsible for what I am.

q.

Sloppy

Neat

r.



Dissatisfied with my body

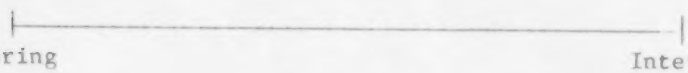
Content with my body

s.

Avoiding

Confronting

t.



Boring

Interesting

u.

Grouper

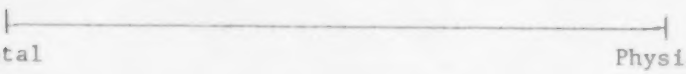
Loner

v.

I have ways of spiting the demands I make on myself(sabotaging self-demands)

I make many demands upon myself

w.



Mental

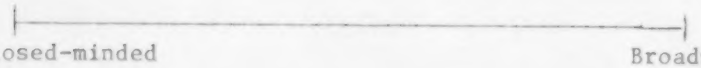
Physical

x.

Dishonest

Honest

y.



Closed-minded

Broadminded

z.

I need to be controlled

I need to be in control

aa.

Liberal

Conservative

bb.

cc.

dd.

ee.

ff.

gg.

hh.

ii.

jj.

At the conclusion of this exercise, consider the following questions:

1. Which polarities were most significant for you?

2. Did you experience tension, anxiety, or discomfort in considering some of the polarities?

3. Were there certain ends of a particular choice that you immediately denied as being relevant before really considering that choice? Are you in touch with avoiding anything as you worked on this exercise?

4. Did you discover anything about yourself as you worked on the exercise?

5. For items that represent real conflict, is there any way to reach a synthesized-integrated position without denying either end of the continuum? Following the article "The Mathematical Art Form," we shall consider the technique of Gestalt dialogues. Using this

technique, each polarity is given a voice and states explicitly what it wants ("I am _____'s sloppy side and I want to fling my clothing all over the room when I get home from work." "I am _____'s neat side and I want clothing hung up in an orderly fashion..."). After this, the two voices attempt some sort of compromise position, involving specific give and take, without making long winded speeches. (In this somewhat trivial example, if "Sloppy" stated that when less exhausted clothing would be later hung up, this compromise might satisfy "Neat.") This sort of ambivalence dialogue can be written as a two-character play. If you decide to try this with one or more of the ambivalences, be sure to let each polarity completely state what he/she wants before you begin the (sometimes difficult) process of negotiating a compromise. Keep in mind that it may not be possible to reach a compromise position for the moment. It may be enough for each pole to express its wants (needs) and for you to become aware of the huge gap between the two sides. Don't rehearse these dialogues in your head but actually try doing one (How does this reflect a straight-stoned difference?), becoming aware of what you feel as you write the dialogue.

6. In the case of obvious conflict, are there ways in which you can use this conflict to your advantage? What are the payoffs of conflict? (Asked in another way, what do you gain and lose from the major polar conflicts? Example: "The conflict keeps me involved and I avoid boredom." "The conflict prevents either extreme from seizing too much control.") Are there ways that you can use some of the ambivalences as a source of energy and/or creativity?

7. As you consider each "ambivalence line," is there a gap between the position on the line where you would actually place yourself (based on what you do or feel) and the position in which you'd like to be?

8. Are there any ways that your intellect interfered with the experience of this exercise? (Telling yourself "I can't (can't = won't) do this" as you glanced at items (a) through (jj) without trying it or being so analytical and interpretive that you became so busy figuring yourself out that you experienced nothing--other than "why" games (head games).) If you did this, are there other ways in which you use your head to prevent yourself from experiencing things?

9. Invent your own "ambivalence lines," labeling each end and following the four steps given in the directions.

Another exercise developed by the MARP author involves the use of the awareness model rather than the intellect-interpretive model to

examine one's existence.

Excerpted Exercise: Autobiographical Awareness - Part I

Andrew Weil brought out the distinction between thinking and having a direct experience. Indeed, it may be impossible to simultaneously live in your head (producing thoughts, interpretations) and really see, hear, experience what's going on. As Weil put it, "In order to perceive reality directly, one must sooner or later learn how to abandon the intellect and disengage oneself from the thoughts it produces incessantly."64

A student wrote about his experience in "straight" psychotherapy where much of the time was spent analyzing and interpreting his past. "I learned how terribly 'sick' I was--how 'unhealthy' my relationship was with _____ as reflected by dream interpretation, Rorschach (ink blot) interpretation, talk talk talk--but boy oh boy was I a good talker...I had deep intellectual insight into poor me and my dreadful sickness. The interrelated 'whys' of my existence fascinated me, yet despite my great sessions I continued to suffer, overwhelmed by the complication of my life structure with a ballooning list of 'whys', interpretations, all based on my intellectual adequacy. I rarely experienced feeling anything. How could I in the midst of this enormously intricate head game?"

How can one deal with the past in other than an intellectual (interpretive) fashion? After all, your past experiences are over--at least they appear to be over in external reality--so how can one experience the past directly? The point is that although many experiences of your life are "done," they may only be finished in external reality. In your internal reality, they may still be very much alive--perhaps not completed--perhaps a scene that you relive again and again in your head.

One way to deal with traumatic and ecstatic experiences in your past is to bring the past to the present and experience it as if it were happening now. This direct experience with the past does not involve analyzing or interpreting, but rather a reliving of experiences, capturing feelings that accompanied the experience. The following exercise is one on which you can work alone as an ongoing project and (perhaps) as a form of self-growth (therapy). The directions for Part I of the exercise are given below. After completing this first part you can find directions for Part II following the article "Your Life As A Mathematical Structure."

a. Compile all the experiences in your life that remain foreground--experiences that are still alive and important because they were so positive (ecstatic) or negative (traumatic); experiences that represent major changes in your growth or life style; experiences that have affected you deeply. Write each experience as an anecdote told in the present tense,

as if it were happening to you now. As you write down each experience, try to really relive that experience, capturing the mood, your feelings that accompanied the experience without getting into what you think about the experience or your analysis of the experience. Present each experience on a separate sheet of paper.

In order to give you a better idea of how to proceed, we offer the following examples from persons who have worked on this exercise.

"I'm in Phys. Ed. class--all the 7th grade boys (including me) have a crush on Peggy (senior girl) who brings the attendance slips from class to class. We always break up, start coughing in unison, or humming--the 'Peggy ritual' is not taken too seriously by our teachers, who simply continue after the short disruptive break. We're on the basketball court, gym shorts--Peggy enters--I look at her (I wish someone like that would love me)--suddenly two guys from behind me yank down my gym shorts and with them my underwear. Except for my shirt, I'm standing there stark naked--Peggy is staring at me; all the other boys are laughing at me. Horror, humiliation--I want to crawl into a hole and take cover from this cruelty. I yank my pants up--howls of laughter--my available resources provide me with no comeback. Numbed with humiliation..."

"Seeing younger Bill----. 'Hi, little Bill.' A strange look from him. Oh, my God--that's not Bill, that's Tom----. Bill was his older brother who died six weeks ago in a car accident. WHAT HAVE I DONE?! OH MY GOD!!"

"I am on stage in the _____production of Damn Yankees. As 'Appelgate,' I have the most dynamic number in the show--'Those were the Good Old Days' belting the number in my devil impersonation-alive-building to a show stopping Al Jolson finale. Saturday night--the audience rises to its feet at the conclusion of my number. A standing ovation!! I feel tingles all over my body; I'm naturally speeding. FABULOUS!!"

"Arriving on the second floor of the mental institution. Elevator shuts behind me. I walk down an empty, drab corridor. How has this happened?! I'm lost in the drama that I create. Controlled by my own play. One pregnant girl (Ellen, brilliantly mad Ellen, nurturing baby Jesus, a second coming that would have as its finale nailing retained virgin-body liquids to a cross)--an empty alcove. I am terrified--numb. Sickly yellow walls. Bars on the window. My most dramatically controlled fall. Being served lunch, tearing apart a piece of cold, leather meat with a spoon. No knives--no forks--starting at the bottom of a hierarchy that promises dining room privileges, third floor (no locks on doors) privileges, ground privileges, privileges--all I need to do is fit in to an obviously insane world...drugged--tired--dry mouth--itchy skin--tears--tears--looking through a barred window--the strength of my tears lobotomized and numbed by thorazine."

Once you write down your first anecdote-experience, chances are you will find other memories coming to mind (emerging from the background to the foreground). At times you might want to deal only with a portion of a particular experience.

b. As you continue to remember, keep adding to your "verbal photo album," placing the experiences (each on a separate sheet of paper) in chronological order. Remember that as you write down each experience in the present tense, you want to relive all your feelings associated with the original experience, reporting feelings and reactions.

(One student became so involved with this autobiographical awareness that she actually constructed an album both of memories and photographs of herself that corresponded with the chronological date of the memories. Another student, a talented writer, used poetry to express the anecdotes. Any medium--words, paiting, music, ceramics, etc.--can be used to recapture the essence of all these important experiences.)

c. Once you have relatively finished your chronologically arranged life experiences (you may find that you are continuously adding to the experiences), read through the entire series of anecdotes responding to whichever of the following seem relevant.

1. Are there any <u>themes</u> that seem to occur again and again within your script? (Examples: themes of exaggerated drama/tragedy/comedy; themes of alienation; themes of loneliness; themes of conformity (or non-conformity)

2. If your anecdotes were turned into a stage production or a movie, would they (overall) play best as a comedy? a tragedy? a drama? a thriller? a musical? an inspirational piece? (what else?)

3. Describe various changes that you've gone through as reflected by the anecdotes.

4. Are there some basic ways in which you have not changed as reflected by your anecdotes?

5. Regardless of the medium you worked with (words, paint, crafts, drawing), did you find the medium to be a limitation in terms of capturing moods--feelings of the past, or were you able to make the medium pliable and fluid in order to truly bring the past to the present?

6. Describe the feelings that you now experience reading through the anecdotes.

7. Are there things that you now see (retrospectively) that caused major changes in your direction?

8. Is ambivalence reflected in your anecdotes? (For example, in some memories you may be the victim; in others you may be victimizing somebody else. In some memories you may be rejected; in others you may be doing the rejection. Some of your memories may reflect hurt feelings; in others you might be hurting somebody else.) If your anecdotes do reflect one end of a polarity, is there any way you can also identify with the other side of the continuum? If you do relate to both sides of the coin (that is, you are aware of opposites--possibly in conflict--in your own existence), is there any way in which you can use these opposites as a source of creative energy?

The MARP author also develops Weil's external-internal reality discussion through the use of a Gestalt exercise orginally suggested by Dr. Frederick Perls in Gestalt Therapy Verbatim.[65]

Excerpted Exercise: External-Internal Reality

Dr. Frederick Perls, founder of Gestalt therapy, devised an exercise that illustrates Weil's distinction between external and internal reality. Most people tend to alternate between external reality and withdrawal through fantasy, daydreaming, meditating, half-listening. Some researchers assert that an undeveloped fantasy life may lead to violence, drug abuse, overeating, and less creative use of external reality. With outer-inner oscillation, the following exercise is geared toward enabling you to find your own rhythm, a rhythm that admittedly is somewhat dependent on the situation in which you find yourself. Boring classes, meetings, daily tasks are more likely settings that elicit withdrawal into fantasy than exciting creative moments. You may, particularly in a dull class, have fought the urge to withdraw out of fear that you'd miss "something important" (usually translated as something that will appear on a test) or out of one of your own multitudinous inner voices telling you "you should pay attention."

This exercise can be done alone or in a group. As a group exercise, directions in the following steps can be read by the group facilitator.

a. Take a moment or two to think of a place that you'd really like to be, alone or with other people.

b. Close your eyes and in your imagination go to this place. Take a while to explore as many details of this place as you'd like. Remember the only limits are those that you impose on yourself. In your fantasy, anything can be done and any place can be explored. (Two minute pause)

c. Now come back to the here and now. Open your eyes, look about, and see what you become aware of. Really pay attention to the detail about you. (One minute pause)

d. Close your eyes and go away again. You can go wherever you'd like--to the same place as before or perhaps a different place. Once again, anything is possible. (One minute pause)

e. Open your eyes,again coming back to external reality. As you did before, see how much detail you notice and how fully you can perceive the here and now. (One minute pause)

f. We will now repeat this "shuttle" between external and internal reality in your own rhythm. In the next five minutes, you can withdraw the entire time, or go back and forth whenever you want. Pay attention to where you want to be--what you want from moment to moment.

Questions For Processing the Exercise:

1. Did you notice any changes the second time that you returned to external reality? Did you perceive the here and now more or less vividly when you opened your eyes the second time?

2. If your internal reality situation was preferable to the here and now, how was it preferable?

3. Did your internal reality fantasy provide you with any clues as to what you want? What's missing in the here and now that is present in your fantasy situation?

4. Do the differences between external and internal reality provide you with any directions that you can move in? Asked in another way, can you make your "real" life more like your fantasy life?

5. What else happened to you in this "shuttling" experience?

Additional exercises at the conclusion of The Natural Mind include fifty-three quotations for discussion involving various ways of knowing, with some of these quotations introducing characteristics of the mathematical art form, a group exercise ("On Being Labeled") dealing with ways that linguistic labels sometimes create artificial categories, a shared group fantasy-imagination experience, and an additional group exercise for dealing with the theme of ambivalence.

Blitzer, Robert. "The Mathematical Art Form"

In this second selection from Unit I, the MARP author introduces the nature of the mathematical art form, using the Boolean structure as an illustration of an axiomatic system. Many of Weil's ideas are applied to creating abstraction, including his discussion of external reality (in setting up models that illustrate pure abstraction), limitations of the intellect (mathematical incompleteness is examined by considering Godel's famous theorem), and the reality of ambivalence (polar processes are seen to provide wholeness to mathematical systems). Difficulties inherent in learning about another person's mathematical art form are discussed, along with the effects of masculine-feminine conditioning on dealing with logical abstraction.

The mathematical theme of polarities (ambivalence) is used to introduce the reader to the Gestalt therapy awareness model, with emphasis on the topdog-underdog polarity and dreamwork. Awareness exercises give the reader a chance to use this non-intellectual technique to promote tes own increased awareness.

Also presented in Mr. Blitzer's article and exercises are Plato's cave analogy, the work of Jean Piaget involving children, numbers, and stages of intellectual development, quotations by prominent mathematicians addressing math as a way of knowing, a "yin-yan" mathematical structure, a small group activity involving creation (excerpted in Chapter 1 of the MARP), and a collection of satiric mathematical proofs.

Excerpted Exercise: Established Art Forms

Mathematics is not the only art form that consists of a mold or pattern (undefined terms, definitions, axioms leading to theorems) that is "filled in" by a particular artist. For example, classical Greek tragedy also follows an established form. The leading character at the onset of the play is doing regally well, but one fatal flow in character results in his downfall, with the play ending in either death or banishment. The Greek audience, even though they might not have known the content of a particular play in advance, came to expect these conventions for the tragedy art form, personally experiencing the downfall of the protagonist (leading character) as an emotional purge--a purification of emotions called catharsis.

a. What are some established conventions or patterns in each of the following "art" forms? What are your expectations of these forms? Shakespearean tragedy; Shakespearean comedy; early rock and roll of the 1950s; television soap opera; surrealism in painting; musical theatre; musical movies; the sonata form as a principle of musical structure; Japanese Kabuki theatrical form; haiku Japanese poetry; Greek pottery; television commercials; horror movies.

b. As you consider the forms listed in part (a) (or other forms with which you might be familiar), it is obvious that simply filling in a mold with content does not necessarily lead to art. In your opinion, what are some of the characteristics involved with form filling content which enables us to call the completed work "art"? If you're not sure, select one of the molds from part (a) with which you're familiar and use that as a basis for eliciting characteristics of art.

c. Can you think of examples in which an art form evolves, grows, expands with the artist? (For instance, musical forms used initially by the Beatles evolved dramatically in their later collective--and individual--work.)

d. Topic For Debate or Discussion: No artist ever says, "I will cast away all forms," for there can be no art without form. All artists seek some sort of form which best fits what they have to say. The difference between emotions/ideas in life and emotions/ideas in art is that art shapes the emotions/ideas into a framework, elevating them from a personal level to a more enduring realm. (Contrasting perspective: The ultimate artistic form has no form. The beauty of ultimate order can be found only in random moldless chaos.)

Excerpted Exercise: The Mathematical Art Form--Straight and Stoned Thinking

The following table illustrates major ideas in Andrew Weil's straight-stoned thinking characteristics:

STRAIGHT THINKING	STONED THINKING
External Reality	Internal Reality
Intellect	Intuition (Insight)
Opposites Exist in Conflict	Opposites Part of a Unified Whole

Where would you classify each of the following ideas involved with the mathematical art form in terms of one of the six "slots" in the table? Justify each classification. (Some items may be placed in more than one compartment. Others may not precisely fit into the available six compartments.)

a. Learning the rules of another person's mathematical game.

b. Not being able to prove a theorem in a mathematical game; going out to play tennis when in the midst of the match, while not thinking about the proof, suddenly getting an idea on how to carry through the proof.

c. Leaving the tennis game, going back to the proof, carefully molding your idea into a well formulated demonstration of the theorem.

d. Holding the belief that only mathematical structures that can be used really constitute true art.

e. Creating your own mathematical game.

f. Creating an axiomatic structure with a rule asserting that "everything both is and is not."

g. Using a theorem from (the game called) trigonometry in order to measure the height of a building.

h. Resenting having to take this math course since it does not at all apply to what you'll eventually be doing.

i. Considering "the sum of the angles of a triangle is 180^{o}" and "the sum of the angles of a triangle is not 180^{o}" as similar statements since they evolve in a unified process.

j. Blaming a poor previous education on your "inability to do math."

k. Noting that results of mystical experiences of the East parallel the theorems of the analytical Transfinite Number mathematical structure.

l. Creating a new logical structure in order to describe experiments with LSD-25 ("acid"). (See John C. Lilly's The Human Biocomputer and The Center of the Cyclone)

Excerpted Exercise: Gestalt Dialogues

> "Verily all things move within your being in constant half embrace, the desired and the dreaded, the repugnant and the cherished, the pursued and that which you would escape.
>
> "These things move within you as lights and shadows in pairs that cling."
>
> "And when the shadow fades and is no more, the light that lingers becomes a shadow to another light.
>
> "And thus your freedom when it loses its fetters becomes itself the fetter of a greater freedom."
>
> from The Prophet by Kahlil Gibran[66]

In exercise 6 (Becoming Aware of Ambivalence) following The Natural Mind, we developed the idea that acceptance of your own ambivalences--polarities--leads to the formation of an integrated personality. (If you have not yet done so, read through this exercise.) We will now give you a chance to consider inner polarities by writing a short play or carrying on a dialogue with an empty chair. These techniques were developed by Dr. Frederick (Fritz) Perls through Gestalt therapy, who urged clients to "lose your mind and come to your senses." These are not exercises where we wish to interpret, analyze, or produce theories, but simply suggestions to give you a better awareness of what you do and how you do it (not why you do it). In this case, you can work on the what and the how (your style) of two ambivalent parts of yourself.

Begin by choosing an area of conflict, contrasting feelings, or contrasting behavior within your life. Perhaps the following suggestions will be helpful:

Suggestion 1. Consider items (a) through (j) of example 6 in the previous section. These items may clearly suggest a conflict in your feelings or behavior on which you can do some work. One student, a "tough" ball player who felt it necessary to deny feelings of warmth, tenderness, and softness, was intrigued by item (k).

Soft-Vulnerable ⟷ Hard-Aggressive

using this continuum to develop a dialogue between his hard-tough-aggressive-machismo side and his (hardly ever expressed) soft-tender-vulnerable side. In expressing his tender needs, the response from his other part (which he later recognized as having great similarities in style to his father) was filled with contempt and scorn ("you're just a pussy-whipped fag--not a real man--" etc.). In his dialogue both voices were totally different in style, and nowhere ready for compromise. In fact, his two parts didn't even listen to one another.

Another student, aware of sexual feelings, fantasies, and

curiosities that had never been acted upon and experiencing discomfort with feelings that did not conform to expected patterns of "normalcy", used item (j)

as a basis for self-dialogue (a most risky choice, but nobody ever promised that any form of self-growth is easy!).

Suggestion 2. Take an identifiable area of conflict right now in your life. Example: I want to continue my relationship with _____versus I want to leave _____; A decision whether or not to tell a parent/friend/lover something important; A decision whether or not to remain in school; etc.

Suggestion 3. Topdog-Underdog Dialogue. In Gestalt Therapy Verbatim, Frederick Perls describes an ambivalent topdog-underdog polarity which forms the basis of our so-called self improvement life script. The topdog is the part of oneself that is filled with "shoulds"--ideas for self improvement, for becoming the perfect student, the perfect parent, the perfect worker. The topdog makes demands with "you should" and "you should not," with threats of catastrophe/failure/loss used as a basis for manipulation." If you don't do well in this course, you'll never become a _____," "You should be a loving son or else your aggravation will kill your mother- you know she's not well," "You should start studying or you'll flunk the test," "You should not touch yourself, because if you do you'll go to Hell..." And so the topdog bombards us with "shoulds," "should nots," scenes of catastrophe--always with a self-righteous aura. Topdog knows best! Despite how nasty and threatening topdog gets, it's all dished out under the umbrella of self-improvement.

But there is another pole in what is really a self-torture game. The other self-character in the piece is the underdog who spites topdog with "O.K.--good idea. I'll do it later," "I'm trying as hard as I can but I just can't seem to do well in the course," "I have such good intentions to be a loving son, but whenever I'm with them I get thrown out of balance," "What can I do?" For you see if you were to do all the things that topdog demanded of you, topdog would eventually shut up. But topdog lives in a constant state of frustration, frustrated by the underdog part of self that apologizes, plays helpless, puts things off till "later," whines a lot, avoids, acts weak, defensive, stupid--really throwing the other character into a tizzy! The underdog, playing weak and helpless, is very cunning and gets the better of the topdog, as the inner parent-child, controller-controlled conflict continues. Underdog keeps the game going!

Most people use this form for the content of their self-torture game, assuming that the topdog is "right." Regardless of which pole you think is "correct" (and if you must think about it, think about how many

impossible perfectionistic demands the topdog makes), both poles are part of the ambivalent self, giving one a chance to explore the differing desires and styles of the two sides.

The following excerpts are taken from topdog-underdog dialogues:

Topdog: You should do your exercises every morning and evening; it's healthy for you, and you're not getting any younger. When summer comes around you'll be glad you listened to me. Those bikinis are getting smaller and smaller.

Underdog: Sometimes I'm just too tired. I wish I could be more disciplined and I really try. So I miss a few days here and there.

Topdog: So! Here you are again, the last week of classes and you're pulling the same old tricks again?

Underdog: What do you mean the same old tricks?

Topdog: You know what I mean. Staying up all night trying to cram before the finals and do the half-done research projects. Just half done, half messy, half passable.

Underdog: I just don't have any other time to do my studying until late at night. After everyone's in bed.

Topdog: Time!! You have just as much time as anyone else in your class.

Underdog: But I have to work. I go to school full time and hold down a full time job. When I come in I'm tired and I just can't study when I'm tired.

Topdog: That's not the real reason. You're lying. You can't fool me. You procrastinate because you're dumb. You don't know what you're doing...

Underdog: I don't want to be in the _____program. It's bullshit! It depresses me! I don't want to spend four years of my life emmeshed in educational jargon with a group of castrated "edbiz" uncletoms, producing reams of worthless data. I want to quit!

Topdog: Quit! I hate that word. Nothing is worse than a quitter! Let me tell you something--with your ability, talent, work habits--you can do anything! The world is yours if you just exert yourself an inch in any direction...

Suggestion 4. Consider what you do versus what you might like to do. This area involves what you express versus what you censor.

Hopefully these four suggestions will give you a number of possible directions for developing a self-dialogue. We will first consider the steps for approaching this exercise as a written play, although after presenting these steps another suggestion for carrying out the exercise will be given.

a. Now that you have decided on a particular area, decide which character-part is to speak first. In writing the script for this part, try to be this component of yourself--experience what it feels like to be this part of you as you state quite specifically what you want (what are your needs?) and/or your purpose for existence (what is your fuction in this world?) If you do a topdog-underdog dialogue, you might (as the topdog) want to begin each sentence with the words "You should..." (or "You shouldn't--"), making a long critical list.

b. After expressing this voice, write a similar statement for your conflicting part. Once again, within this contrasting role, state explicitly what you want and/or your purpose for existing. In the case of a topdog-underdog encounter, you can either respond to the long list of "shoulds" or first express your own desires devoid of all the "shoulds."

c. After "voice 2" has spoken (call your inner parts "voice 1" and "voice 2," or give them names if you feel you have names that "fit"), switch characters again, and let the first character respond to the second character's statement of needs.

d. At first this technique might appear artificial (try doing it rather than rehearsing it in your head), but see if you can continue the dialogue between your two ambivalences, switching parts whenever you choose. Don't try to control the dialogue or your feelings as you change from one role to another. As you write each part, try to actually become that part of yourself, being as animated, alive, dramatic, and specific as possible in expressing your needs, answering the other voice, etc. Whenever the two parts feel finished, or at an impasse, stop the dialogue.

We once again offer a short example of such a self-dialogue:

VOICE 1: What! Last week you were telling me that you could separate sex and emotion, and now you're telling me this!!!

VOICE 2: Well, yes, it's not just a matter of putting in fixed cubby-holes sex and emotion, I'm telling you that I feel I can love more than one person.

VOICE 1: Of course, you love your parents, sister, nephews, etc., but more than one man??

VOICE 2: Yes, I realize now that I'm married, I have all the sex I want, but that I still feel that I am cutting myself off from the real world by being so limited.

VOICE 1: Limited! Are you crazy?

VOICE 2: No, I don't think I'm crazy, just realistic.

VOICE 1: Realistic, in whose eyes?

VOICE 2: I'm the only one who can judge me, and I feel how can it be wrong to love.

VOICE 1: But the love you're talking about is between a man and a woman right?

VOICE 2: Yes, that's right.

VOICE 1: And you're telling me that you're contemplating going to bed with more than one man.

VOICE 2: Well, don't make it sound like an orgy, all I'm saying is that I feel it is possible to have affection and love outside of marriage without hurting my feelings for "a".

VOICE 1: I think you're one mixed up broad.

VOICE 2: Listen, I'm sick of you making me feel guilty, as if I were 12 years old and a nun was moralizing me.

VOICE 1: That's what religion is for--to keep people like you in line.

VOICE 2: I don't need to be kept in line, I'm not dashing out looking to get screwed! All I'm saying is that I won't hide feelings inside me and make myself feel dirty.

VOICE 1: God, if your "mother " ever knew.

VOICE 2: But I didn't tell my Mother how to live her life.

VOICE 1: Yes, but she brought you up with religion.

VOICE 2: I'm happy it was good for her, and maybe even happy I had it as a child, but I feel adults need to make their own decisions.

e. Consider whatever questions are relevant for you after completing the ambivalence play:

1. How do the styles of the two parts differ? (Is one part more "earthy-vulgar" than the other? Does one part act weak--the other strong? Do their vocabularies differ? Is either character a bully?)

2. Does either style remind you of anybody you know (parent? teacher? relative? the Church? the Synagogue?)

3. Is the style of each character appropriate for getting what it claims to need?

4. What did you feel in your body--how did you hold your body--what did you experience--as you wrote each role?

5. Does each component of your personality express <u>explicitly</u> what it wants, or does it get involved in long winded speeches which tend to confuse the issues?

6. Do the voices listen to one another? Are they making any kind of contact or simply holding fast in their positions? Do the voices appear to be heading for some sort of compromise?

(If so, can you write a dialogue in which specific give and take can satisfy both parts and result in a relatively comfortable compromise?) Do the voices seem to be heading toward a shoot-out? A stand-off?

7. How do the characters place demands on one another? Are they explicit or manipulative and underhanded? Do they confuse one another? Do you experience confusion reading through the dialogue?

8. What do you get from this conflict? (Example: I keep myself from being bored.) What do you gain? What do you lose?

9. What do you experience as you silently read through your dialogue? as you read the dialogue aloud?

10. Are there ways that you sabotaged this exercise for yourself? (Telling yourself that you "couldn't" get into it before trying to do so; getting confused and not knowing what to do; half rehearsing a dialogue in your head, planning to write it down but destroying spontaneity through over-rehearsal, etc.) If so, are there other areas of your existence in which you effectively self-sabotage--block yourself from getting what you set out to accomplish?

Quite frequently, this sort of dialogue-exercise can be acted out using chairs facing one another, using one chair in which to express one feeling-part and switching chairs as you change roles. In external reality you wind up talking to any empty chair; in your inner reality you fantasize that sitting in the empty chair is the other character (part of yourself) with whom you are speaking. Again, be as animated and dramatic as possible in each chair, switching chairs whenever you choose. Some people record the dialogue so that at the "end" they have an opportunity to hear themselves and experience the sound of their voice in each of the two roles. A silent observer might also be useful to point out, at the conclusion of your little "life play," how you used (or did not use) your body in each of the two roles.

With the realization that much conflict comes from within, one can take responsibility for the conflict and do something about it other than blaming or complaining. The first step in this process is to gain an awareness of ambivalent voices (conflicting parts) within by directing them outward, through writing or dialoguing with an empty chair. Frederick Perls' Gestalt Therapy Verbatim contains a detailed discussion of this technique within the (easily understood) principles of Gestalt therapy, along with numerous examples of persons writing their life scripts.

Excerpted Exercise: Gestalt Therapy and Dreams

Gestalt therapy provides a technique for working on dreams that

does not involve either interpretation or the playing of intellectual games. Instead, dreams are relived as if they were happening in the present, acted out as a drama that is now taking place rather than told as a story in the past. The dream is viewed as a message about the existence of the dreamer, with the various parts and characters acting as fragments of the dreamer's personality. You may find that giving each part of your dream a voice--playing each part, dialoguing among parts, putting the fragments together (thereby reowning projected, fragmented parts of your personality, along with hidden potential)--is more valuable than interpretive games.

If you have a dream or a dream fragment that you would like to work on, with the possible outcome of gaining increased awareness of your existence, here is a technique that you can follow.

a. Say the dream aloud in the present tense. Pretend that you are on a stage and that you are presenting your dream as a theatrical piece for an imaginary audience. Be as animated, dramatic, alive as possible, playing all roles (do the dialogue), setting the stage for your audience, trying to convey the feeling of the dream using your voice, body, appropriate verbal images, and whatever else you deem appropriate. In other words, your dream is now a piece of existential theatre in which you are author, narrator, actors, set designer, et.al. REMEMBER TO HAM IT UP AND KEEP EVERYTHING IN THE PRESENT TENSE!

b. After you have completed your performance, what part of the dream stands out most for you? Go back to that part and work on it in greater detail by giving each object, person, or element a voice that might not have been expressed in detail in the original dream. Begin with that object or person and PLAY THE PART. Start by identifying yourself ("I am the mud in _____'s dream that makes it so difficult for him to walk")--give the object or person a voice and describe yourself, tell what you want, tell about your purpose for existence ("I exist to make things difficult for _____ so that he can never reach his destination"). What else do you have to say? Again, ham it up and keep everything in the present tense.

   Once you have given words to a character or thing whose emotions were unspoken in the dream, you can now respond (as yourself) to that voice. Respond in the present tense, and keep the dialogue going. Tell the object/person how he/she/it makes you feel. What would you like to do to the object or person?

   Similarly, act out each of the elements of your dream, letting each part describe itself, talk about its purpose for existence, and its needs. Let the parts of your dream dialogue with one another, dealing especially with parts that seem to be in conflict.

   Since your existential message (dream) has numerous characters or parts (all with something to say), there will probably be

many dialogues you can write (or act out with an empty chair) between any two parts, between yourself and one of the parts, or among more than two parts. Since this is your dream, you are in the best position to choose a dialogue or area that would be most meaningful for you. Frederick Perls suggests that you "really transform yourself into each of the different items...Use your magic. Turn into that ugly frog...the dead thing...the demon..."

c. What have you discovered about your existence? Again, do not interpret but see if you can sum up your existence in terms of a clear cut message of the dream. For example, the person who played the mud that made it difficult to walk might sum up that part of the dream with, "I block myself. I keep myself from reaching my goals. This is my existence now." Aim for an awareness of your existence, rather than placing a judgment on it ("That's'sick'."), trying to change into something else("I'll 'try' not to block myself."), or blaming or interpreting ("The reason that I block myself deals with an experience that happened to me when I was..."yawn). The aim, then, of the dreamwork is to unravel a message about your existence by bringing the dream back to life.

d. Were there any situations that you avoided in your dream? Did you wake up just prior to a major confrontation? If so, see if you can finish the dream by going back to that part of it and acting through the unfinished business--the frightening situation--in fantasy. If, for example, you avoided going through a door, start with that part of the dream and allow yourself a "daydream" (excursion into your inner reality) in which you walk through the door, exploring what happens to you. Stay with the feelings and emotions of your daydream.

e. Keeping a Dream Journal

Another technique is to record your dreams over a period of a few months, writing down each dream in the present tense as if it were now taking place. After doing this for a period of time, reread your dream journal, compiling a dream overview. What recurring themes do you notice? Is there a single theme or many themes to your dreams? Do your dreams have a tendency for closure? What are you avoiding in your dreams? Is there a repetition of what is avoided? What are the existential messages of your dreams (the relationship of your dreams to your here and now style of being in this world)? What else are you aware of?

Blitzer, Robert. "Your Life As A Mathematical Structure"

Godel's theorem, proving tnat the creation of logical structure leads to statements which appear to be true yet cannot by proved nor

disproved, is used as a pivotal point to discuss characteristics of existential philosophy. The famous map coloring problem, formally the finite intellectual enigma of the topologists, is discussed in relationship to undecidable statements. Existential poetry sets the tone for self-awareness exercises that can be done both individually or in groups.

The second half of the article is an unusual exercise constructed by Mr. Blitzer, integrating existential characteristics with the nature of a mathematical structure. A psychological concept is that behavior is a function of perception. What one does is a reflection of feelings (perceptions) about oneself, one's capacity to love, one's intellectual capacity, feelings about one's body, feelings of worth (or worthlessness), perceptions of one's environment (friendly or hostile), and so on. In a sense, we can view our behavior (what we do) as the theorems of our life, with underlying perceptions representing the axioms, definitions, and undefined terms of our self-mathematical model. In this exercise, the participant is asked to examine tes behavior within the framework of a deductive system, and then consider alternate behavior-theorems by changing one's underlying structure.

Following this exercise is a discussion item based on the opinions of existential philosophers and educators, an example presenting unsolved problems of Number Theory, an item presenting various existential systems, and an exercise employing two persons based on the existential theme of responsibility. In addition, the MARP author invites the reader to pursue the following general directions.

Excerpted Exercise: Autobiographical Awareness - Part II (Part I was presented at the conclusions of The Natural Mind.)

d. Read through your chronologically arranged life experiences. At the end of each experience, consider the decisions you made as a result of that particular experience. These can be decisions about yourself, the general direction of your life, about other people, "society," the country--anything at all. Write each decision as if it were an axiom--a rule of your existence structure.

For example, take the anecdote involving the junior high school student who was humiliated in front of the senior girl "Peggy." Perhaps this student decided that people were cruel and insensitive. This would be stated as an axiom--"People are basically cruel and inhumane." All decisions, opinions, perceptions, beliefs that crystallized after each experience should be stated as an axiom. Obviously for some memory anecdotes you will have many axioms; for others you might not have any.

Go through all anecdotes, compiling a list of axioms.

e. Read through your axiom list and cross out any decisions, perceptions, beliefs that you now no longer find valid. Retain only those axioms which you still believe in.

f. Define the key words in your axiom list, not necessarily in relationship to the original anecdote but within the broader context of your present existence. If you still believe "People are basically cruel and inhumane," define "cruel" (or "inhumane") in a way that now applies to your life.

g. Read through your axiom list (part e) and the supporting definitions (part f). Consider this framework as the underlying structure which gives rise to what you are doing or what you might eventually be doing.

1. What are some of the things that you now do (work, relationships, leisure time, school, etc.) which follow from your basic axiom-definition structure?

2. What things are you planning on doing that follow from your axiom-definition structure?

3. What are some of the things that you now do which seem somewhat contradictory with your basic axiom-definition list?

4. What specific things does your axiom-definition list prevent you from doing?

5. Are you considering any changes in your list of axioms? If so, which axioms, and what would you like to change them to?

6. How similar or different is your structure to the value-perception systems of those closest to you in your childhood? in your present life? of people you admire and hold in esteem?

Excerpted Exercise: Disagreements

Two mathematical theorems will disagree in content if they are deduced from different underlying structures. Similarly, people have contrasting views on issues when their underlying value systems--opinions about human nature, the nature of the world, themselves--differ.

The purpose of this exercise is not to create a debate, or to force people to change their opinions or feelings. Instead, it is to examine the phenomena which erupt into disagreement (and, sometimes more violently, into war). Two volunteers with contrasting opinions will be writing value statements in front of the rest of the group.

a. The group leader will read a statement. Two group members will be asked to come forward--one who strongly agrees with the statement and another who strongly disagrees with that statement.

b. The person who strongly agrees should write one key axiom indicating a basic belief, value, or perception that gives rise to her/his position on that statement.

c. The person who strongly disagrees should change the first axiom to support her/his position, again writing the axiom in front of the group.

d. The "strongly disagreeing" person should now write an original axiom in support of his/her basic position. The "strongly agreeing" person will then change this axiom to support the contrasting position.

Both persons will continue until they feel that the important values supporting their position have been written.

Group members should ask for clarification on the axioms, if necessary, requiring the volunteers to define crucial words used in the value statements.

After all axioms are written, group discussion and reactions should follow.

Suggested "hot items" to consider (position statements can also be invented by the group): Education needs a return to the basics--reading, writing, arithmetic; Marijuana/Prostitution should be decriminalized (or legalized); Parents have no right to impose their religion on their children; I would encourage premarital sex for my daughter/for my son;

Free enterprise should be modified with social reform provided by the government; Persons whose orientation is not exclusively heterosexual should be allowed to teach at the elementary (high school, college) level; Young couples should live together before getting legally married; Most schools today are exciting places; We'd all be better off without organized religion; Grades should be abolished; Young boys should be permitted to play with Barbie dolls; A former male who has undergone a sex change operation should be permitted to enter a major women's tennis tournament; Masturbation can be just as rewarding as other forms of sexual expression; The primary responsibility for raising children belongs to the woman; The real heros of the Vietnam war were the persons who said "no" and left for Canada; Most people have some homosexual feelings (or curiosity); The Government itself was involved in the murder of President Kennedy.

Excerpted Exercise: Saying No

A psychology class entered the room, took their seats, and the instructor pressed the start button of a tape recorder on the front desk. The tape exclaimed, "I'm perfect--Are you perfect? I'm perfect--Are you perfect?" again and again, repeating the phrase hundreds of times, eventually becoming extremely annoying to class members. What did the students do? They sat in their seats and suffered, being much too much the "perfect" students to do anything about an obnoxious situation (either asking the instructor to press the "stop" button or doing it oneself). Collectively the group said "yes" to a situation which many persons wanted to affirm "no." Saying no, the existential word that defines one's spirit of resistance, went against the grain of the conceptualized perfect (polite, never making waves) student, avoiding possible confrontation with the teacher or other class members by powerlessly (giving away one's power) doing nothing.

a. Think of a recent situation in which you said "yes" but where you really wanted to say "no." Once you have decided on the situation, replay it <u>in your head</u> exactly as it took place. Try to really relive it as if it's happening at this very moment. Be aware of the sound of your voice and the power of your voice, particularly as you say "yes." It will probably be easier to relive the encounter if you close your eyes. Be sure not to change anything that took place.

b. As you relive the situation, how do you feel? What are you gaining? What are you losing? Listen to your voice.

c. Again, close your eyes, but this time (in fantasy) <u>change</u> what really took place by saying "no." Say all the things that you didn't originally express. Tell this person (or those people) what <u>you want</u>, devoid of their expectations of you. Let your "no" define your existential boundaries.

d. As you change the situation, now saying "no," how do you feel? What are you gaining? What are you losing? What does your voice sound like?

e. Write a Gestalt dialogue (see #13 following "The Mathematical Art Form) between yourself and the person(s) to whom you just said "no." Begin by playing the other person, responding to your "no" and dealing with the rejection. After doing this, write your own part in the dialogue, answering the other person. Let this person know in what ways you are separate and different from him/her/them.

f. Continue the dialogue, actually experiencing what it feels like to be both yourself-rejector and the other person(s)-rejected. The dialogue should flow based on what you feel. Do you experience different sensations as you create the two parts?

As you engage in the dialogue, see if you can avoid holding back anything. Let the other person know anything you've been censoring. Do you have any resentments toward this person? Let him/her/them know what they are. Any demands? Appreciations? Express how you feel toward one another.

g. When you feel finished with the dialogue, or taken it as far as it is going to proceed, bring the script to a close. Reread the dialogue that you've written, considering the following questions:

1. What does saying "yes" do for you? (Examples: I get love. I avoid hassles.)

2. What does saying "no" do for you?

3. How do you give power away to other people for gaining support, approval, love, etc.?

4. In terms of the conformist-rebellion continuum, where does real freedom lie for you? What can you do to bring yourself this freedom?

Synge, J. L. "Euclid and the Bright Boy"[67]

In this short story, Mr. Synge uses satire to point out the need for undefined terms within a purely logical structure. Following the article, the MARP author places the story within an historical context by presenting mathematics before Euclid (Pythagorean math and numerology), selections from Euclid's Elements, and mathematics after Euclid (game theory).

Russell, Bertrand, "Mysticism and Logic"[68]

Mathematician, philosopher, and social critic, Bertrand Russell examines the general characteristics of mystical philosophy, including the use of intuition, the belief in a unified Realty beyond the world of appearance, the denial of time, and the Goodness of everything (evil being an illusion produced by the divisions and oppositions of the analytic intellect). Unlike Weil's discussion of "stoned thinking," Russell presents a critique of each metaphysical characteristic, arguing that although mysticism may contain an element of wisdom and inspire that which is best in humans, philosophically (logically) it is unsound, representing the mistaken outcome of emotions.

The MARP author presents various changes in Russell's mental development, including his position (developed decades after writing "Mysticism and Logic") that logical abstraction is not an "abstract edifice subsisting in a Platonic heaven" into which one can permanently retreat, but just a human intellectual creation that to a mind of sufficient power would appear virtually trivial. Russell's later point of view is that intellect is not superior to sense, and indeed there are other ways of gaining access to the "real" world other than through abstract logic.

Excerpted Exercise: Ways of Knowing

Each item in the following list represents a possible source of knowledge. Which of these ways of knowing would most appeal to a) Bertrand Russell (in "Mysticism and Logic") b) the mathematical artist ("The Mathematical Art Form") c) the straight thinker? the stoned thinker (The Natural Mind)? d) the existentialist ("Your Life as A Mathematical Structure")? e) you? (Give examples of things you now know, values you hold, opinions you have, which were developed by each knowledge source.)

1. I know based on authority and testimony of others--society, the United States, parents, religion, teachers, authors, friends, et. al.

2. I know based on what I feel--what I sense (see, hear, taste, touch, smell). Knowledge comes through sensation.

3. I know by carefully thinking things out, using reasonable self-evident forms such as "p is either true or false," "p is not both true and false," "if p is true then p is true." I use my intellect to decide if A is less than B and B is less than C then A is less than C. I know not through raw sensation but rational forms, principles which enable me to think things out.

4. I know about people through the "vibes" they send out. I can tell just by their "aura" whether or not they can be trusted. With my present partner I fell in love at first sight. I always know through quick apprehension.

5. I know through use of my imagination, day dreaming, and fantasy.

6. I know an Ultimate Good (God) through a direct inspirational vision of Reality--a revelation.

7. I know not by seeing the "real" but being (one with) the "real."

8. I know through integrated use of intuition, intellect, and sensations.

f. What other sources of knowledge can you add to this list?

Unit II of Confluent Math, Infinity, examines the notion of infinity from the mathematical abstract perspective and the direct mystical infinite experience, with supporting literary asides. Unusual results from the mathematical art form dealing with infinite numbers and infinite sums are interwoven with mystical threads ("Infinity and Higher Consciousness"). The notion of infinity, raising the premise that the way we perceive things (finitely) may not be the way they really are, is developed in an excerpt from an early science fiction story (Flatland) as well as in a selection by Russian mathematician-mystic P. D. Ouspensky who suggests that what we experience with our senses (what we see, hear,

smell, taste) is a cross sectional finite slice of an infinite higher reality (Tertium Organum)!

Readings within the unit include:

Blitzer, Robert. "Infinity and Higher Consciousness"

The MARP author uses a mystical approach to introduce both mathematically and philosophically some of the unusual (from the point of view of ordinary finite logic) aspects of infinite or transfinite numbers. Reiterating general themes from earlier articles, Mr. Blitzer discusses the infinity of infinite numbers, a whole being equal to one of its parts, logical paradoxes, and a view of mathematics as a safe intellectual way of sharing the perhaps terrifying intuitive experience of infinity. Exercises develop Bertrand Russell's definition of a number, the notion of infinite series, calculus as an outgrowth of the classical paradox that motion is impossible, and operations of additional and multiplication on transfinite numbers.

The unusual nature of infinity (both mathematically and from the perspective of ordinary consciousness) sets the tone in the opening paragraph from "Infinity and Higher Consciousness":

> An immense degree of irony will permeate much of the discussion that follows. To deal with the notion of infinity on the intellectual (ego) level is a fascinating, but relatively safe experience. To actually experience (as opposed to think about) infinity through an intuitive eradication of all limits, in short to move beyond the limitations of the third dimension into a world devoid of ego boundaries, is the gut level essence of what I would like to deal with. Yet it is impossible to do this through words, for as long as words exist, as long as there is an "I" separate and distinct from the pen with which I am writing, and the paper on which I am writing, as long as there is a beginning, middle, and end, as long as I continue to imprison myself by the abstractions of external reality (as I feel I must do to communicate in this particular media) then I ironically must talk about the

experience of infinity. To experience infinity, seeing myself writing this paper, seeing myself seeing myself writing this paper, seeing myself seeing myself seeing myself writing this paper, and so regressing infinitely, would, at the moment of reaching the infinite regression, enable me to say "I am the paper," or better, "I am the Light." As long as I see the Light I can communicate with you safely; when I experience the Light within the positive joy and elation of losing my mind, then my timeless insanity can be communicated only through a model reflecting my experience. At the moment I cannot let go; the best I can do is to share with you, through my isolation and existential loneliness, a conceptual model, the elephant shit of which, from the point of view of my "still small voice," I choose to be initially apologetic about.

The deliberately abrupt intellectual-mystical shifts in tone throughout "Infinity and Higher Consciousness" are "de-mystified" (so to speak) and linked into a logically supportive chain in the development of exercises following the article.

Excerpted Exercise: The Intellect-Direct Experience Split: Infinity

As previously mentioned, mathematical theorems proved within the framework of intellectual abstraction frequently echo the intuitive experiences of those who have dealt directly with infinity. The article "Infinity and Higher Consciousness" suggests that mathematical abstraction is a safe shield behind which one can glance intellectually at a mystery that may be very threatening when experienced first hand.

Items on the left are direct quotations from the experience of infinity. At the right are intellectual abstractions from the trans-finite number art form. Where possible, match the items by number, discussing ways in which they parallel and reinforce one another.

	THE DIRECT EXPERIENCE	THE INTELLECTUAL ABSTRACTION
1.	"Brahman is infinite; the universe is infinite. The infinite proceeds from the infinite. Taking the infinitude from the infinite universe leaves the infinite Brahman alone." (Swami Madhavananda)	1. Taking $\aleph_0$ objects from a set containing $\aleph_0$ objects leaves $\aleph_0$ objects. $(\aleph_0 - \aleph_0 = \aleph_0)$
2.	"Thou art That" or "Thou art both thou and not thou" (from the teachings of the Indian philosophers, the Upanishads)	2. There is an infinity of infinite numbers-- $\aleph_0, \aleph_1, \aleph_2, \aleph_3$, etc. (Some infinites are not equal to other infinites.)

THE DIRECT EXPERIENCE	THE INTELLECTUAL ABSTRACTION
3. (Describing Heaven and the Gods) "For light everywhere meets with light; since everything contains all things in itself and again sees all things in another. So that all things are everywhere, and all is all. Each thing likewise is everything. And the splendor there is infinite. For everything there is great, since even that which is small is great...There each part always proceeds from the whole, and is at the same time each part and the whole. For it appears indeed as a part; but by him whose sight is acute, it will be seen as a whole..." (Plotinus, On Intelligible Beauty)	3. An infinite subset (part) is equal to the original infinite set (whole). (The whole is equal to one of its parts.)
4. "Tao is a great square with no angles, a great sound which cannot be heard, a great image with no form." (The Sayings of Lao-Tsu, VI Cent.B.C.)	4. $\{1,2,3,4,5,...\}$ and $\{23,24,25,26,...\}$ and $\{10004,1005,1006,...\}$ all contain the same number of objects. $(\aleph_0)$.
5. "That (manifest ever-changing creation) is full, this (unmanifest nonchanging self) is full. From the Full emerges the Full. The Full coming out from the Full leaves the Full." (Maharishi Mahesh Yogi)	5. There are more numbers between 0 and 1 than there are in the infinite collection $\{1,2,3,4...\}$.
6. "Nor by prolonging life do we take one tittle from the time passed in death nor can we fret anything away, whereby we may be a less long time in the condition of the dead. Therefore, you may complete as many generations as you please; none the less, however, will that everlasting death await you; and for no less long time will be no more in being, who beginning with today has ended his life, than the man who has died many months or years ago." (Epicurean philosopher and poet Lucretius)	6. Are there any infinite numbers between $\aleph_0$ and $\aleph_1$? This question remains mathematically (intellectually) unanswered.

7. "I was back where I had been when I was looking at the flowers--back in a world where everything shone with the Inner light, and was infinite in its significance. The legs, for example, of that chair--how miraculous their tubularity, how supernatural their polished smoothness? I spent several minutes--or was it several centuries?--not merely gazing at those bamboo legs, but actually being myself in them; or, to be still more accurate (for 'I' was not involved in the case, nor in a certain sense were 'they') being my Not-self in the Not-self which was the chair."
(Aldous Huxley describing his perceptions after taking mescaline in The Doors of Perception)

Abbott, Edwin. (selections from) Flatland: A Romance of Many Dimensions[69]

Abbott pictures a two-dimensional world in which sense experiences prevent the inhabitants from grasping ideas of a higher reality, in this case the world of three dimensions. Once again the mathematical theme of using the imagination and transcending the world of appearance is examined, this time within the framework of science fiction.

The MARP author integrates the themes of non-ordinary consciousness and mathematical art with the episodes from Flatland. Also discussed are the characterizations used in the story. Can the science fiction medium deal both simultaneously with ideas and people, so that characters become more than walking symbolic abstractions? The course participant is invited to take the ideas expounded in the readings to develop science fiction fantasy, blending allegorical speculation with fully dimensional character studies (unlike those of Flatland).

Excerpted Exercise

The creation of mathematical art involves liberation from the straight notion that the way external reality appears is the way it must be represented within mathematical structure. Novel ideas that transcend external reality--that represent notions, operations, transformations not limited to what is physically possible in the real world--lie at the base of the mathematically creative mind.

In Flatland, most of the characters refused to acknowledge the possibility of conceptualizing a world beyond the one to which they have become accustomed.

a. How would the philosopher Plato react to this perspective? (See p. 6 of "The Mathematical Art Form.")

b. How does the visitor, the sphere from the third dimension, reflect the same narrow perspective (the way we see things is the way they must be) as the Flatlanders?

c. Aldous Huxley described the changes in his perceptions of three dimensional space after taking mescalin (The Doors of Perception). As you read about Huxley's perceptions, see if you can compare the Flatlander's threatened reactions to the leading character (they confined him permanently) to our society's reactions to the non-ordinary "psychedelic" experience. Why do you suppose that so many people get upset over these "upward not northward" experiences? In what ways do these reported experiences threaten our straight conceptualizations?

> "...the perspective looked rather odd, and the walls of the room no longer seemed to meet in right angles. But these were not the really important facts. The really important facts were that spatial relationships had ceased to matter very much and that my mind was perceiving the world in terms of other than spatial categories. At ordinary times the eye concerns itself with such problems as Where?--How far?--How situated in relation to what? In the mescalin experience the implied questions to which the eye responds are of another order. Place and distance cease to be of much interest. The mind does its perceiving in terms of intensity of existence, profundity of significance, relationships within a pattern. I saw the books, but was not all concerned with their positions in space. What I noticed, what impressed itself upon my mind was the fact that all of them glowed with living light and that in some the glory was more manifest than in others. In this context position and the three dimensions were beside the point. Not, of course, that the category of space had been abolished. When I got up and walked about I could do so quite normally, without misjudging the whereabouts of objects. Space was still there; but it had lost its predominance. The mind was primarily concerned, not with measures and locations, but with being and meaning."[70]

Excerpted Exercise

In Flatland, the concept of "upward not northward" was one which made no sense in terms of the external reality of the inhabitants. The fact that one person explored beyond the visible world and came upon an idea that was, in a sense, a "vision beyond," caused ridicule, ugly lables ("crazy," "unpatriotic"), and eventual confinement. As we explore our own inner realities--as we come in touch with our feelings--many of us find ourselves in a similar position to the protagonist of Flatland. Expanding our universe beyond what is acceptable, beyond what is apparent to most people who function totally in external reality, can cause us both joy as well as pain; to share our feelings/visions/beliefs/fantasies/ideas--to share the unique individual "insanity" of our inner reality often takes a great deal of risk taking.

Deal with one or more of the following in any manner that you wish. You may want to discuss these, invent a play-dialogue where you express these ideas-feelings and have SOCIETY answer you (or your parents answer you), write a science fiction surrealistic fantasy based on one or more of these ideas, paint a picture reflecting the feelings of your "craziness," write music that reflects these feelings--any media that you feel will reflect any one or more of the following:

a. What are some of the "craziest" ideas that you have ever had?

b. What are some really unpopular statements reflecting either how you feel or alternatives you have chosen in your life?

c. What would you like to do that you can't because of external reality?

d. What things are impossible in external reality that are a part of your inner reality?

Excerpted Exericse: A Need For Ritual Persecution?

> "When, for example, the question arose about the treatment of those lunatics who said that they had received the power of seeing the insides of things, I would quote the saying of an ancient Circle, who declared that prophets and inspired people are always considered by the majority to be mad; and I could not help occasionally dropping such expressions as 'the all-seeing land'; once or twice I even let fall the forbidden terms 'the Third and Fourth Dimensions'.
>
> It is part of the martyrdom which I endure for the cause of the Truth that there are season of mental weakness , when Cubes and Spheres flit away into the background of scarce-possible existences; when the Land of Three Dimensions seems almost as visionary as the Land of One or None; nay, when even this hard wall that bars me from my freedom, these very

> tablets on which I am writing, and all the substantial realities of Flatland itself, appear no better than the offspring of a diseased imagination, or the baseless fabric of a dream."71

a. For experiencing and sharing a vision that threatened the existing status quo, the leading character in Flatland was severely persecuted by his society. Discuss actual examples of individuals or groups in twentieth century America who similarly questioned the way things were (people with different ideas, orientations, politics, mannerisms, and so on). In what subtle or overt ways were these individuals or groups persecuted?

   (Of interest is the violent reaction to the mathematics of the infinite, described in "Infinity and Higher Consciousness." The creator of this art form, Georg Cantor (1845-1918), was violently persecuted by his contemporary mathematicians for this "disturbing" theory. With personal animosity against Cantor directed primarily by mathematician Leopold Kronecker, Cantor spent his final days confined in a mental institution.)

b. Moving beyond persecuting those with threatening ideas, does humankind have a need to solidify its own position through the ceremonial persecution of "others--whether these "others" be women burned at the stake (as witches), Jews exterminated in Nazi Germany, suspected "Communists" put on blacklists, the lynching of Blacks, "drug pushers" serving long prison sentences (this excludes, presumably, the retail merchant who pushes alcohol), homosexuals receiving "aversion therapy" to "change" them into heterosexuals, etc.?

   In order to effectively examine this question, you may want to take persons or groups mentioned above (or others) and begin examining the way that language is used as a scapegoating device--the Jew as "Christ Killer"--the gay as "sick" (needing "treatment")--the Black as"primitive savage." Like the leading character in Flatland, the vermin-like quality taken on by the "they" enables the ceremonial scapegoating to appear as the natural order of things, with confinement, torture, or extermination viewed as "necessary for our well-being." After all, where were the cries of indignation over the treatment of the Flatlander grandfather? Somehow the "Proclimation" that established the grandfather as a verminous enemy brought the persecution into the accepted order of the way things were supposed to be.

c. In what ways could an awareness of our need to ritually persecute through the seeking of scapegoats enable us to recognize when we are engaged in this ceremonial behavior, and consequently move toward a more humane treatment of one another?

Ouspensky, P. D. (selections from) Tertium Organum

Russian mathematician and mystical philosopher Peter Demianovich Ouspensky uses the Flatland allegory to discuss a world beyond the known world of phenomena--an infinite, four-dimensional world of noumena governed by higher laws of mathematics and logic. The choice is no longer logic versus mysticism, but rather developing a new form of logic to describe a higher mystical state of reality. Ouspensky's mathematics of transfinite numbers, paralleling the MARP author's discussion of the infinity of infinite numbers, forms the axiomatic foundation of his four-dimensional world, a world he claims we perceive in three-dimensional cross sections. Ouspensky, reiterating the idea that mathematics escapes the finite limits of the visible and measurable world, finds axiomatics ahead of finite thought, and therefore able to bring science to mysticism as a key to unlock the mysteries of a higher reality.

In the exercises following Tertium Organum, the MARP author relates Ouspensky's world of noumena to transfinite numbers, the linear (past, present, future) construction of time (developing the Cartesian coordinate system as an example of linearity in a mathematical model), and the notion that our linguistic tradition decreases awareness of conceptualizations beyond the everyday finite three dimensional world. Numerous literary examples given by Aldous Huxley, Carlos Castaneda, Benjamin Whorf, A.H. Maslow, George Leonard, William James, and William Blake reinforce many of Ouspensky's ideas.

The exercises (and Unit II) conclude with an invitation to the

reader to develop tes own personal meaning for the concept called infinity. Additional suggestions include the construction of a model for the infinite and the invention of a unique mythology about the creation of the world (and/or the universe).

Unit III, Symbolic Logic, provides specific focus to the general ideas developed in the first two units, through the construction of a logical abstract game. Beginning with a consideration of the ways in which specific vocabulary (content language) shapes, affects and determines our experiences ("Language--Content and Form"), we move beyond a content language to develop a language of pure form ("The Underlying Structure of Symbolic Logic"). Basic new statements are proved using this foundation ("The Theorems of Logic"), employing these new statements to decide whether the conclusion of an argument is valid ("Validity of Arguments"). The formal logical structure is considered both in relationship to bad reasoning in everyday life ("Fallacious Thinking in Everyday Life") and as an illustration of the nature of mathematicas as an art form ("Mathematicas as a Creative Art"). The final selection ("The Truth-Value Analysis") uses the structure of the symbolic logic game to develop an alternate method of proof called the truth-value analysis.

The opening article ("Language--Content and Form"), in looking at problems and issues involved in content language shaping perceptions, presents numerous exercises centered around this theme, including Humpty Dumpty's semantic discourse (from Carroll's Through the Looking Glass), corruption of language and political abuse, language and sexism,

non-verbal communication, and stereotypes (prejudices) associated with linguistic labels and phrases.

Excerpted Exercise: Small Group Experience (4-6 people)

This is an exercise in group decision-making dealing with the grooves, labels, slots, and categories set up within a content language. Your group is to use the method of group consensus in readhing its decision.

You have just had a child, and are wondering about possible choices (life-styles) that your child will make in the future. The following list represents certain possibilities that your child might choose once he or she is a consenting adult. As a group, rank this list starting with the thing or category that you most want to happen. Your highest number will then be the thing that you least want to happen. In ranking as a group, follow these guidelines for reaching consensus:

1. Argue your case as logically as possible, but be open to others' logic also.
2. Avoid changing your mind only in order to reach agreement and avoid conflict. Support only solutions with which you are able to agree somewhat, at least.
3. Avoid conflict-reducing techniques such as majority vote, averaging, or trading in reaching group decisions.
4. View differences of openion as helpful, rather than as a hinderance, in decision-making.

The list to rank (as group)

Your child (in the future) may be:

_____ a United States Senator
_____ a brain surgeon
_____ a communist
_____ a truck driver
_____ a child molester
_____ a beautician
_____ a "lifer" in the military (a military careerist)
_____ a self-sufficient prostitute
_____ being "kept" by a wealthy lover
_____ exclusively heterosexual
_____ exclusively homosexual

_____ bisexual

_____ an alcoholic

_____ a feminine male or a masculine female

_____ an F.B.I. agent

_____ physically unattractive

_____ married interracially

_____ a corporation president

_____ a star in pornographic films

_____ totally dedicated to converting people to Jesus

(REMEMBER - #1 represents the thing that you most want to happen!)

After doing the group ranking, you may wish to discuss one or more of the following questions.

a. As you worked through the ranking, what stereotypes did you associate with the various labels and phrases?

b. Can you identify ways in which stereotypes (prejudices) toward these labels prevent you from relating to other people? Do you use any of these categories to blind you to the person being labeled?

c. What are your objections (if any) to giving up some of the prejudices that you experience with these linguistic phrases?

d. How might your ranking change if you were doing it specifically for a male child? a female child? What prejudices do you experience with the blue-pink dichotomous labels "masucline" and "feminine"?

Excerpted Exercise: Humpty Dumpty's Discourse on Semantics (from Carroll's Through the Looking Glass).

> "I don't know what you mean by 'glory'," Alice said.
>
> Humpty Dumpty smiled contemptuously. "Of course you don't--till I tell you. I meant 'there's a nice knock-down argument for you?'"
>
> "But 'glory' doesn't mean 'a nice knock-down argument,'" Alice objected.
>
> "When I use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean--neither more nor less."
>
> "The question is," said Alice, "whether you can make words mean so many different things."
>
> "The question is," said Humpty Dumpty, "which is to be master--that's all."[73]

a. In his work Symbolic Logic, Lewis Carroll writes, "I maintain that any writer of a book is fully authorized in attaching any meaning he likes to any word or phrase he intends to use. If I find an author saying...'Let it be understood that by the word black I shall always mean white, and by the word white I shall always mean black,' I meekly accept his ruling..." Relate Carroll's point of view to creating mathematical structure as well as to the quote by Humpty Dumpty.

b. "Don't stand chattering to yourself like that," Humpty Dumpty said, looking at her for the first time, "but tell me your name and your business."

"My name is Alice, but--"

"It's a stupid name enough!" Humpty Dumpty interrupted impatiently. "What does it mean?"

"Must a name mean something?" Alice asked doubtfully.

"Of course it must," Humpty Dumpty said with a short laugh; "my name means the shape I am--and a good handsome shape it is, too. With a name like yours, you might be any shape, almost."

Alice was too much puzzled to say anything; so after a minute Humpty Dumpty began again. "They've a temper, some of them--particularly verbs; they're the proudest--adjectives you can do anything with, but not verbs,--however, I can manage the whole lot of them! Impenetrability! That's what I say!"

"Would you tell me please," said Alice, "what that means?"

"Now you talk like a reasonable child," said Humpty Dumpty, looking very much pleased. "I meant by 'impenetrability' that we've had enough of that subject, and it would be just as well if you'd mention what you mean to do next, as I suppose you don't mean to stop here all the rest of your life."

"That's a great deal to make one word mean," Alice said in a thoughtful tone.

"When I make a word do a lot of work like that," said Humpty Dumpty, "I always pay it extra."

"Oh!" said Alice. She was too much puzzled to make any other remark.[74]

In the content language of English, proper names do not have a meaning other than denoting a particular object. Other words (like "impenetrability") have general agreed upon significance. Explain, in the quotations above, how Humpty Dumpty is inverting and reversing this usual convention.

Excerpted Exercise: Language and Sexism

Edward Sapir, a famous linguist, reiterates the theme that content language affects our thinking, our perceptions, and our awarenesss. He writes "Human beings...are very much at the mercy of the particular language which has become the medium of expression for their society. It is quite an illusion to imagine that one adjusts to reality essentially without the use of language and that language is merely an incidental means of solving specific problems of communication or reflection. The fact of the matter is that the 'real world' is to a large extent unconsciously built upon the language habits of the group...we see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation."[75]

Otto Jesperson, another eminent linguist, states that English is "The most positively and expressly masculine of all the languages... the language of a grown-up man, with very little...feminine about it."[76] Based on this thesis, the view of the world transmitted by language is the world as it looks to men, frequently displaying contempt toward women. The purpose of exercise is to bring some of the sexist implications inherent within the English language to one's conscious level of awareness. We begin by considering some examples from the American Heritage Dictionary.

"Man"	"Any human being, regardless of sex or age, a member of the human race; a person." (Thus humanity comes to be thought of as being male.)
"Woman"	"Women collectively, womankind: Woman is fickle."
"Womanish"	"Effeminate and weak"
"Male"	"virile, manly"
"Army"	"A large body of men organized and trained for warfare on land."

To deal with the interrelationships between language and thought-grooves, consider the following male-female non-sexist exercise. In each row you will find a word or phrase for which you are asked to find a male or female counterpart word or phrase conveying the same idea, and carrying the same emotional connotation. Finally, see if you can use a humanistic non-sexist oriented word or phrase to convey the concept.

Samples:	MALE	FEMALE	NON-SEXIST
	man	woman	person
	mankind	womankind	humankind
	the office boy	the office girl	the clerical staff
a)	man--made	_____	_____
b)	forefathers	_____	_____
c)	_____	Mrs. Jack Jones	_____
d)	_____	girl (as a synonym for adult females)	_____

	MALE	FEMALE	NON-SEXIST
e)	_____	lady doctor	_____
f)	_____	Ted Johnson & his wife Mary	_____
g)	_____	chick	_____
h)	_____	old maid	_____
i)	proving his manliness	_____	_____
j)	_____	dame	_____
k)	_____	honey	_____
l)	_____	old lady	_____
m)	lady's man	_____	_____
n)	fag	_____	_____
o)	_____	a loose woman	_____
p)	family man	_____	_____
q)	_____	career girl	_____
r)	_____	she henpecks her husband	_____
s)	swish	_____	_____
t)	_____	castrating bitch	_____
u)	_____	just like a woman	_____
v)	_____	nympho	_____
w)	a real man	_____	_____
x)	I pronounce you man and wife	_____	_____
y)	_____	ball buster	_____
z)	_____	whore	_____

You may quickly become aware how difficult it is to find counterparts that express an equivalent idea, especially a non-sexist expression for a word reflecting cultural contempt for women. For example, the negative connotation to the female label "nympho" becomes almost positive with the masculine counterpart "stud" although "swinger" may reflect the non-sexist alternative.

The degree to which language reinforces the unconscious belief that it's a man's world can also be brought out in the following game. Since you have read through the material thus far, it is best that you be player #1 and a person who is not familiar with the nature of sexism and language act as player #2. Your job is simply to read each of the sentences below, one at a time, while player #2 responds in such a way that the sentence becomes a question.

Samples:

Player 1. Marth is intelligent.
Player 2. Is she?
Player 1. We're talking about sexist language.
Player 2. Are we?

Player 2 is to use a personal pronoun in formulating the question. Keep track of the pronouns used, afterword discussing how they reflect basic sexist assumptions. Watch to see if player 2 uses "he" to reflect values of intellectual accomplishment, initiative, and enterprise and "she" to reflect domestic accomplishments, timidity of soul, gentle appearance, dependence, etc. In some of the examples (such as the first sample) one particular pronoun is indeed correct (in this case "she" to indicate Martha, but in most examples player 2 is given a choice.

As player 1, you will feed your co-player each of the following sentences, one at a time with an immediate question coming from player 2.

My cousin speaks Chinese fluently.
My cousin married a millionaire.
My child is extremely attractive.
That person is crying.
The CIA agent broke the law.
The baby is crying.
My cousin earned a doctorate.
My cousin keeps an immaculate home.
My cousin is really built!
The president of the company is a crook.
The boat is sinking.
That child is a real tomboy.
Nixon was a crook.
Mrs. Gandhi destroyed democracy in India.
Sue will stay.
That person won a gold metal.
My cousin has long golden eye lashes.
That person is washing the dishes.
My cousin is a secretary.
That person's spouse earns a fabulous income.
That person founded this company.

"Language--Content and Form" is one of three sections from the opening article in Unit III. Readings within the unit include:

Blitzer, Robert. "Introduction to Logic"

After discussing content language, Mr. Blitzer lays the foundation for an axiomatic logical form language, presenting the undefined term. axiom, and definitions of the structure.

Blitzer, Robert. "The Theorems of Logic"

Basic theorems (tautologies) of logic are proved using the foundations

established in the previous article. Proof of the law of the excluded middle is followed by a reiteration of the higher logic of Ouspensky (Tertium Organum) and the stoned-awareness conceptualizations of Weil and Perls. Problems enable the reader to add new definitions to the structure, thereby expanding the list of theorems generated from the underlying foundation. Exercises also develop electrical networks as an alternate model for symbolic logic.

Blitzer, Robert. "Validity of Arguments"

Introducing the framework of the formal proof, the theorems of logic are used to decide whther the conclusion of an argument is valid. The process involves focusing on the form rather than the content of the argument, with examples from Lewis Carroll's writings represented as symbolic abstractions.

Kupperman, Joel and Arthur McGrade. "Fallacies"[77]

Bad reasoning, or logical fallacies in both the content language (English) and the form language (symbolic logic) are discussed, with movement from fallacies in formal logic to fallacies in everyday life situations. The MARP author presents exercises in which the course participant is asked to examine bad reasoning both from within as well as from without (in advertising, news reporting, political extremism, Watergate rhetoric, etc.). The MARP author also presents the role-playing technique, using the technique as a means for acting out the fallacies (employing a cast of ten!) in a given situation (a student attempting to "deal" marijuana to fellow students, each person responding in a logically fallacious manner, with extra roles developed

illustrating the existential and logical positions.)

Halmos, P.R. "Mathematics as a Creative Art"[78]

Mr. Halmos presents a case for considering mathematics as a creative art form. The MARP author follows the article with an application of these ideas to the specific nature of the symbolic logic structure, inviting the student to view the entire system as an art form.

Excerpted Exercise: Mathology and Theories of Art

"Mathematics can be just as beautiful, just as peak-producing as music; of course, there are mathematics teachers who have devoted themselves to preventing this. I had no glimpse of mathematics as a study in aesthetics until I was thirty years old, until I read some books on the subject."[79]

(A. H. Maslow, The Farther Reaches of Human Nature)

Aesthetics, defined as the theory of art and the experience of beauty, encompasses a number of representative theories on the nature of art, including:

1. Art as Imitation. Central to this theory is that art must imitate something--objects, people, human emotions. Art can reflect an individual object or person, or an Ideal existing in the world of Good (in which case, said Plato, the art is an imperfect copy of the Ideal), or it can imitate a universal characteristic of humankind.

2. Art as Pleasure. The function of art is to give pleasure, so that if people who view the art are pleased (or entertained) then the art is "good art."

   (It is possible to combine theories (1) and (2) defining art as the imitation of that which is pleasant.)

3. Art as Revelation. Art is a relatively concrete form that reflects a higher reality. In this context, the transfinite number structure, revealing an Infinite fourth dimensional world of Noumena (see Tertium Organum), enabling us to transcend our ordinary three dimensional existence of faulty sense perception, is considered art. Art is a kind of mathematical model for the non-physical forms of higher reality, enabling the viewer to achieve liberation through an aesthetic experience.

4. Art as Play. Art, generated by the energy level of the individual, enables the imagination to freely and spontaneously discharge excess energy--energy which needs expression in some form other than through usual tedious work activities. Through art, the energy of the imagination finds expression in this elevated form of relaxation and spiritual play.

5. Art as Communication. Just as language is used to communicate thoughts, art is an activity in which the artist constructs signs to communicate her/his feelings or emotions to other persons who may then experience similar feelings. According to this theory, the need to communicate feelings is at the heart of the artistic impulse and the aesthetic response.

6. Art as Expression. The artist's primary interest is to express emotion, intuition, insight, inspiration, and values that cannot be expressed through ordinary avenues (common use of language, body language, etc.). Unlike the art as communication theory, individual artistic expression is of crucial significance regardless of whether this expression is communicated to an audience or evokes similar feelings in a potential audience. The work of art is related exclusively to the artist's expression and not to audience receptivity.

7. Art as Empathy. Have you ever left a movie almost physically exhausted because you became so involved with the characters--tightening and relaxing your muscles as the plot unfolded? This empathetic response involving the projection of your subjective state into the art object so that you temporarily become infused with it, takes place as you move your body to music, brace yourself watching a cinema shark attack a swimmer, become aroused at an erotic verbal passage in a novel; in short where you experience (perhaps to a lesser degree) feelings similar to what you would experience if you participated in the event depicted by the art. These sympathetic muscular reactions are at the heart of the aesthetic experience as an empathetic experience for the viewer.

8. Art as Experience. This theory attempts to integrate art with the experiences of everyday life. There is art in satisfaction over a routine chore well done, or in the body movements of a tennis player. Art concentrates on what is vital and significant in ordinary experiences, intensifying these vital and significant characteristics, raising them in order to enrich experience as well as extracting from the experience a more vital significance. Art is not identified with a painting or a mathematical structure removed from the human experience that gave rise to the particular form.

   a) Take each of the eight theories and discuss specific ways in which the mathematical art form (mathology) can be viewed

from each perspective. Do any of the theories in no way fit the nature of mathology? In this case (or cases) could mathophysics be viewed as an example of that particular theory?

b) Take each of the eight theories and specifically discuss ways in which the symbolic logic structure does or does not adhere to that definition on the nature of art.

c) According to Halmos, what is art? Which theories of art does Halmos draw upon in his discussion?

d) How does Halmos measure a "good" mathological art form? Which theories of art does Halmos use in measuring goodness in mathematics?

e) Discuss the analogies (given by Halmos) between the following creative arts: mathology and chess; mathology and music; mathology and literature; mathology and painting. What additional analogies can you devise between mathology and other creative arts?

f) Of the eight theories of art, with which would you most agree? disagree? How do you personally define art? Can you add additional theories of your own to this list? (Think about experiences or situations which most frequently evoke an aesthetic response in yourself.)

Excerpted Exercise: Topics for Debate and Discussion

What opinions do you have over the following statements? Give specific examples to support your pro or con position. These items are excellent for debate and group discussion.

a. Art cannot be defined or fit into one of eight neatly compartmentalized theories. (Asked to explain modern art, Pablo Picasso responded with, "Do you require an explanation for the song of a bird?")

b. In the best interests of the moral fabric of a society, there should be some censorship of art--particularly art which is vulgar, which encourages "perverse" or violent behavior, or which threatens the "national security" of the state.

c. Artists are special people who, because they are less bound by the ordinary than other people, should be given greater social, moral, and even legal flexibility. (A junior high school, with a rigid dress and hair code, should not harass a world famous bearded-blue jeaned artist who has taken a temporary position at the school; A country with repressive marijuana laws should not refuse to grant citizenship to a world famous musician even if the musician was "busted" in that country for possession of less than an ounce of grass. You can, certainly, give numerous other examples in relationship to this position.)

d) With people starving throughout the world, as well as the misery of human want and deprivation here in the United States, it is wrong for the federal government to pour money into a "useless luxury" like art.

e) All artists create with the expectation of communicating to others rather than as a means of self expression without concern for how others will react.

f) Competitive free enterprise (the capitalistic structure) does far less to elicit and encourage artistic effort than a socialistic economy in which the government subsidizes the creative efforts of the artistic community. Capitalism is insensitive to the notion of "art for art's sake" since the all pervading profit motive has nothing to do with pure artistic creativity.

g) One reason for voter apathy in the United States deals with the enormous gap between the state of our art and the state of our government. If we could elevate government to the cultural level reflected in the best of American film and American music, this creativity in government would generate a liveliness of response among the people.

Blitzer, Robert. "The Truth-Value Analysis"

An alternate method of proving theorems in symbolic logic is presented, culminating with a satiric excerpt of the "Gestalt therapy prayer" to be resolved as "true" or "false" using the technique of truth-value analysis.

Unit IV, Group Theory, also provides specificity for the general remarks made about the nature of mathematics in Unit I, particularly the theme that wholeness comes through opposite processes and operations providing structural balance. We begin by defining the concept called group ("Introduction to Group Theory"), examining examples so diverse in content that only the group definition can provide unity and meaning to what would otherwise be unrelated chaos ("Group Theory and the Postulational Method"). Group form serves as a means for solving traditional

algebraic equations, furniture moving equations, clock-like system equations, and matrix equations ("Group Theory and Algebraic Equations"). Finally the group definition-structure gives us a new way of viewing the human mind along with a cyclic theory of time built upon the clock-like nature of many groups ("The Group Concept").

Readings within Unit IV include:

Blitzer, Robert. "Introduction to Group Theory"

The mystical notion involving the unity of all structures forms the basis for the definition of a group. Examples that appear totally different in content are unified by this definition. Problems involved with learning abstraction are discussed within the article. The last example dealing with the various arrangements of three pieces of furniture, seen as an example of the unifying group definition, forms the basis for the article to follow.

Denbow, Carl and Victor Goedicke. "Group Theory and the Postulational Method"[80]

The authors discuss the furniture arrangements as a group, moving toward the solution of equations within the system. The MARP author presents a collection of problems at the end of the article giving the reader a chance to work with the group definition discussed in the first two readings.

Blitzer, Robert. "Group Theory and Algebraic Equations"

The MARP author presents a general group theorem that can be used in solving specific algebraic equations. In addition to the

kinds of equations that appear in introductory algebra, the unifying theorem is used to solve abstract group equations, equations that appeared in the Denbow and Goedicke selection, modular equations, and matrix equations. The problem set contains additional group theorems for the interested reader to prove.

Blitzer, Robert. "Group Theory and Equations Involving More Than One Operation"

A general group equation is solved, unifying algebraic equations in one unknown involving more than one operation. The selection also includes group equations with more than one operation, as well as a procedure for solving "word problems" that traditionally arise in algebra.

Keyser, Cassius. (selections from) "The Group Concept"[81]

Keyser presents a model in which the "mind" might be viewed within the framework of the group definition. In addition, the author presents a theory of time (the philosophy of the cosmic cycle) developed from the concept of modular groups. At the conclusion of the reading, Mr. Blitzer presents various philosophies dealing with time, as well as a role-playing simulation (for two role players) centering on the theme of time disorientation. Also discussed is the system of complex numbers as another content example fitting the group form definition.

Excerpted Exercise:

a. Briefly paraphrase Keyser's discussion of the mind as group.

b. Give definite examples of non-closure within your own learning experiences. Put in another way, give examples of situations where you understood "concept A", you understood "concept B", but you were not able to grasp a new concept built from A and B.

c. How do you personally deal with not understanding a topic, an idea, or a subject; particularly when those about you seem to be catching on? What kinds of messages do you give yourself?

d. What other factors, devoid of the non-closure of mental phenomena, seem to contribute to not understanding a topic or idea? (Examples: poorly written textbooks; disorganized class presentations; not being interested in the topic.) Examine specific situations in which you have not understood. To what extent are you responsible for this non-comprehension and to what extent do you blame factors external to your mind (such as lousy teachers, sleep inducing textbooks) for your non-comprehension?

e. Consider parts (c) and (d) in terms of your previous mathematics (or arithmetic) education.

f. For some people, rather than work hard in the "role" of student and face potential failure, they simply do nothing (or very little) so that failure or low grades becomes equated with not trying very hard rather than with the non-closure of their mind. It may be safer to deal with "I failed because I didn't try" than "I failed even though I worked hard, so the failure is related to my own lack of ability in this area." To what extent do you personally relate to this position?

g. Consider parts (c), (d), and (f) in terms of your learning experiences with this unit on groups.

Excerpted Exercise: Time

The question "What is time?" has fascinated scientists, philosophers, and mystics throughout the ages. Does time exist or is it merely an abstraction built upon our limited perceptions of reality? Is every moment eternal with the linear movement of past, present, future just another human limitation (Tertium Organum)? Is there any validity to Keyser's hypothesis:--does modular group theory provide the form for a universe trapped in a perpetual infinite cycle? Did we create the abstraction called time in such a way that we cannot now free ourselves from our Frankenstein monster? Could time be multi-dimensional? Is time order arbitrary, random, chaotic? Can we only approach the moment in a calculus-like fashion by considering an interval of time (Δt) and then allowing that interval to shrink to, but never reach, zero (limit)? Why is it that as we get older, external time seems to get faster and faster? Why at certain moments (anxiety attacks, drug experiences, high fever, sense deprivation) does time undergo distortion, or lose its meaning entirely?

$\Delta t \to 0$

Obviously we have no intention of answering these questions. This very moment and the meaning of this very moment are, indeed, inseparable. But your own personal philosophy of time gives meaning to your present

moment. If time is an illusion that does not exist, the moment is for opening perceptions to transcend the illusion. If time is random and chaotic in a universe without order, it doesn't make much of a difference what you do with the moment. If time is cosmic, the moment has very little new to offer. If time is linear where only the "fit" make it to the future, the moment should be used productively for self improvement to guarantee survival in this competitive process. The NOW is only a part of a larger picture which, for you, may be final with your death, be cosmic, linear, illusory, viewed in the context of reincarnation, and so forth. Your personal conceptualization of time is related to your finite limits, orienting and directing the meaning of the moment.

a. Construct a model representing your personal perspective of the abstraction called time. The model can be a line, circles, a chart--anything that visually represents your own philosophy of time. (Ouspensky's time model appears in exercise 2 following the excerpt from Tertium Organum.)

b. On your model, indicate the position (in time) where you are now.

c. On your model, indicate how much time you have spent and how much time is left.

d. How do you feel about your own relationship with time? Are you content with the way that you've spent your time so far?

e. Use your model to indicate if you've been here before and will be here again (cosmic cycle philosophy), or to show where you came from and where you will be going.

f. Where are you most of the time--thinking about (reliving) the past, in touch with the present, or anticipating what's going to happen next (the future)? Where would you like to be most of the time? Who's in charge--you or time? As you answer these questions, see if you can incorporate the answers symbolically into your time model.

> "I always remember that I have everything I need to enjoy my here and now unless I am letting my consciousness be dominated by demands and expectations based on the dead past or the imagined future."[82]
>
> (Ken Keyes, Jr. Handbook to Higher Consciousness)

g. As you examine your model, do you appear to be heading somewhere? If so, how do you feel about where you're going? How do you feel about where you are at the moment (now)?

h. An interesting group exercise is to have people share their time models while telling the group of their personal meaning of time. Discuss how this personal philosophy of time shapes, directs, and (perhaps) limits your relationship with the moment.

Excerpted Exercise: Group Theory as a Creative Art

a. Take each of the eight theories on the nature of art (exercise 4 following "Mathematics as a Creative Art") and specifically discuss ways in which group theory does or does not adhere to that particular theory.

b. In what ways does group theory adhere to the characteristics of art set forth by P. R. Halmos (see "Mathematics as a Creative Art")?

c. Reread the last paragraph of the introduction to this unit. What opinion do you now hold regarding group theory-abstraction? Is it "soul imprisoning," supreme art, a bit of both, or neither? To what extent is your opinion shaped by the closure of your own mind, which relates to your learning experiences throughout the unit? To what extent is your opinion shaped by the kinds of experiences and activities that uniquely turn you on?

Unit V, External Reality and the Inductive Method, looks at science (or the research method) as a mode of inquiry, relating this method to the philosophic traditions of Western civilization. In this last unit, we move from a realm of pure abstraction, limited only by the imagination of the artist (mathematics) back to the world of external reality known to us through our senses. The steps in the scientific method are presented, introducing much of the vocabulary of "statistics" ("The Methodology of Straight Thinking"). Science and mathematics are contrasted as modes of inquiry, with a reiteration of the broader question: How does one know? Use of the computer is considered in relationship to the experimental method, with further discussion involving the computer and consciousness, artificial intelligence, computers programmed to perform psychotherapy, political issues

involving the computer, and the computer in relationship to mathematics ("The Computer"). Our final selection (hopefully more of a reference to persons in education, the social sciences, and psychology than a reading selection per se) fills in the arithmetic gaps of the research method, presenting step by step computational procedures for performing various statistical tests ("The Computational Aspects of Straight Thinking"). The mechanical arithmetic is livened up (somewhat) through inclusion of a "survey of sex surveys" involving the work of Kinsey, Masters, and Johnson.

Selections within this final unit include:

Blitzer, Robert. "The Methodology of Straight Thinking"

The MARP author presents the inductive research method as a reflection of Andrew Weil's (The Natural Mind) "straight" thinking. Steps within the experimental method are presented as components of an actual experiment. Also considered are the ways that statistics can be used to distort external reality and produce useless data. Without involving actual computations, Mr. Blitzer discusses statistics of central tendency, variability, z-scores, the normal curve, t-scores, and accepting or rejecting the null hypothesis. Contrasting perspectives are viewed in relationship to the inductive method, once again considering the broader question: How does one know?--with answers given by William James, Jacob Bronowski, Albert Einstein, George Kirchhoff, Alfred North Whitehead, Abraham Maslow, John Lilly, and others. Affective and cognitive exercises are generated from the classic Milgram behavioral study of obedience and the work of B.F. Skinner.

Excerpted Exercise: The Research of B. F. Skinner

B. F. Skinner, in his scientific approach to the study of behavior, concerned himself with what could be observed. His traditional laboratory setup, called the Skinner box, consisted of a rat which had undergone twenty-three hours of food deprivation, a cage, a lever the rat could press, and a chute for providing a pellet of food each time the rat pressed the bar. The idea was that if the response of pressing the bar were to be reinforced by a pellet of food, the rat would actually learn this bar-pressing response.

The items below represent findings from Skinner's research. For each item listed below, talk about possible applications as well as limitations that make it impossible to take the laboratory results and apply them to five real life situations. The five real life situations you are to consider for <u>each</u> item are:

1) You are a second grade teacher of slow learners.

2) You are a parent of a three year old child.

3) You are in the process of creating an "ideal" society--a Utopia.

4) You are in charge of a prison reform program at a large state prison.

5) You are a therapist of a group of convicted rapists.

Skinner's findings include:

a) If a response of an organism (bar pressing) is followed by reinforcement (a pellet of food), the probability of this response increases.

b) If the learned response (bar pressing) is then <u>not</u> followed by reinforcement, the probability of the response decreases (the rat eventually stops pressing the bar) and the response goes to extinction.

c) If the rat is taken from its Skinner box for fifteen minutes after the response has become extinct, upon being returned to the cage the rate of response increases after the rest period! (This response increase, recurring as a function of rest between experimental sessions, is referred to as spontaneous recovery.) However, despite a short interval of spontaneous recovery, without reinforcement the response rate decreases fairly rapidly.

d) Skinner used the notion of length of time to extinction to measure the strength of a response. Strong responses are highly resistant to extinction learning. Furthermore, he found that the <u>kinds</u> of reinforcement affected the strength of the response. When a reinforcement occurred on a variable schedule (rather than reinforcing every response, reinforce <u>some responses</u> at random) the behavior was highly resistant to extinction. (By the way, any application to the compulsive gambler who plays the slot machine, compelled by the possibility of random reinforcement?)

e) After the bar pressing response was built in (learned) by reinforcement, the rat received a mild shock (punishment) after pushing the bar. Very rapidly, the responses went to extinction. However, as soon as the shock (punishment) was stopped, the bar pressing activity returned. In this controlled environment, it was found that punishment depresses behavior temporarily but not permanently.

f) The greater the amount of initial training, the less the effects of punishment are.

g) Some animals were shocked not for pressing the lever, but simply in general. In this case, a specific response was not being punished, yet the punishment made the rat fearful, and decreased bar pressing resulted. In the laboratory setting, punishment seemed to have an effect that carried over into many areas of behavior.

Excerpted Exercise: The Rights of Experimental Volunteers

To what degree does one submerge the rights of experimental volunteers to obtain results that will serve humanity at large? George B. Leonard, in Education and Ecstasy, lists principles related to this issue:

1. "The voluntary consent of the human subject is absolutely essential."

2. "The experiment should be constructed as to avoid all unnecessary physical and mental suffering and injury."

3. "During the course of the experiment, the human subject should be at liberty to bring the experiment to an end if he has reached the physical or mental state where continuation of the experiment seems to him impossible."[83]

a) A reasonable list? Leonard suggests that you consider yourself the subject of an experiment wherein the "treatment" consists (or consisted) of your public education through late adolescence. Based on your personal experiences, to what degree do the principles cited above violate or support your rights as a subject in the "education" experiment?

Now consider yourself the subject of an experiment where "treatment" consists of the items listed below. To what degree do your personal experiences (if applicable) with these treatments fit in with the three principles listed above?

b) Learning to behave in a "masculine" manner (if male) or a "feminine" manner (if female).

c) Learning "acceptable" channels to direct your sexuality.

d) Early religious experiences.

e) Learning to hate, fear, or dislike an ethnic or religious group (or any group or individual that was "different").

Excerpted Exercise; An Assumption As Independent Variable

IQ tests were given to elementary school children in South San Francisco, with 20 percent of the students placed on a list because (as teachers were told) the test showed they would "spurt ahead" in their learning. Teachers were told that this 20 percent listing of names showed children with great potential and, sure enough, when "achievement tracks" were established this 20 percent did spurt ahead. First-graders on the list gained an average of 24.4 IQ points in one year, while control group gained only 12 points. (Robert Rosenthal, Lenore Jacobsen. Pygmalion in the Classroom.)

It turned out that the information given to the teachers was false, with the 20 percent list in actuality a random selection of students!

a) What did the teachers believe the independent variable to be?

b) In the description given above, what is the dependent variable?

c) What is the real independent variable of the experiment?

d) Discuss implications of this research.

e) What positive "assumptions" made about yourself by family, teachers, friends (who else?) actually added to and directed your positive achievements or directions?

f) What negative "assumptions" made about yourself by family, teachers, friends, etc. actually detracted from possible positive achievements or directions?

g) If you seriously considered question (f), are you at all in touch with blaming others for possible diminished achievements or directions in your life? If so, and you can identify a particular person or group:

1. Make a list of all your resentment toward that person or group. Begin with "I resent you for..." trying to imagine that the other party will see your list, getting in all relevant items. Resentments don't have to make sense, so logic is beside the point. (You may very well resent somebody who is dead.)

2. Make a list of demands toward that person or group, again imagining that the party will read your list. Your demands can be generated from the resentment list, so that if you wrote "I resent you for not being warm and loving to me," you might now write "I demand that you be warm and show me you love me."

3. Make a list of appreciations toward the same person or group, keeping in mind that "appreciation" is not the same as "liking." Begin with "I appreciate you for..."

4. Read your three lists. What do you experience (in your head, in your body) after reading through the lists?

Blitzer, Robert. "The Computer"

Steps in computer use are introduced in relationship to statistical computations. Use of the computer is discussed, particularly in the area of political repression and the invasion of privacy, tying in with existential ideas expounded in "Your Life As A Mathematical Structure." The computer as therapist is also examined, along with ways the computer can be used for the betterment of humankind, and the role of the computer in pure mathematical research.

Blitzer, Robert. "The Computational Aspects of Straight Thinking"

The reader is shown how to compute the various statistics that arise in the inductive method. This article fills in the computational details for the concepts presented within "The Methodology of Straight Thinking."

Hopefully our description of the five units, an overview of the articles, and a sample of the more unusual affective exercises has given the reader a fairly good feeling for the content and tone of Confluent Math. If the reader's appetite is stimulated by parts of Confluent Math we suggest examining the original articles and exercises. In our

overview we included only about one fourth of the affective exercises and none of the purely intellectual abstract experiences, so that the skeleton presented here can be filled in only by consulting the richness of the original text.

In order to discuss the specific ways Confluent Math addresses the values of general education (particularly those values not developed in existing curriculum processes), it is important that the reader get a handle on the specific topics covered in the product. For this reason we are including a list of general topics under the readings in which they appear. After each topic, indicated in parentheses, is the major discipline to which that concept belongs.

Unit I - Introduction to Mathematics

Weil, Andrew. (selections from) The Natural Mind

1. Intellect and/or Intuition as Ways of Knowing (philosophy)
2. External and Internal Reality (philosophy)
3. The Ambivalent Nature of Things: Wholeness Obtained Through Opposites Cooperating Through Conflict (philosophy)
4. Infinity: The Inability of the Intellect to Deal With the Experience of Infinity (philosophy)
5. Personal Self-Awareness Exercises for Dealing with Ambivalence (psychology of human potential)
6. Group Experiences: On Being Labeled/Shared Group Fantasy/ Ambivalence/Shuttle Between External and Internal Reality (psychology of human potential and human relations)

Blitzer, Robert. "The Mathematical Art Form"

1. The Nature of An Abstract Axiomatic Structure (math-philosophy)
2. Plato's Analogy of the Cave (philosophy)
3. Pure Abstraction and Mathematical Models (math)
4. Godel's Incompleteness Theorem (math/logic)
5. The Intellect and Awareness (psychology of human potential)
6. Piaget--Children and Numbers: Invariance of a Transformation (psychology of intellectual development)
7. Boolean Algebra as an Example of Abstract Structure (math)
8. Math and Sexism: Math Anxiety (sociology)
9. Shared Group Activity Involving Creativity (math and human relations)
10. Established Art Forms: Math as Art (philosophy)
11. The Gestalt Awareness Model of Frederick Perls: Gestalt Dialogues and Gestalt Dreamwork (psychology of human potential)

Blitzer, Robert. "Your Life as a Mathematical Structure"

1. Godel's Incompleteness Theorem Leading to a Discussion of Existential Philosophy (philosophy)
2. Numerous Self-Awareness Exercises Based on Existential Ideas: "Who Am I?," "Your Life as a Mathematical Structure," "Saying No," etc. (psychology of human potential and human relations)
3. Unsolved Problems of Number Theory (mathematics)
4. Existential Systems (philosophy)
5. Disagreements: War (philosophy and psychology of human relations)

Synge, J. L. "Euclid and the Bright Boy"

1. Undefined Terms in an Axiomatic Structure (math)
2. Excerpts from Euclid's Elements (math)
3. Pythagorean Mathematics (math)
4. Number Mysticism (numerology; mystical philosophy - the occult)
5. Game Theory (math)

Russell, Bertrand. "Mysticism and Logic"

1. Characteristics of Mystical Philosophy (philosophy)
2. How Does One Know?: Mysticism versus Logic (philosophy)
3. Ways of Knowing (philosophy)

Unit II - Infinity

Blitzer, Robert. "Infinity and Higher Consciousness"

1. The Mathematics of Transfinite Numbers and Infinite Series (math)
2. The Direct Experience of Infinity in Literature and in the "Mystical Experience" (philosophy/literature)
3. Bertrand Russell's Definition of a Number (math/philosophy)
4. Introduction to the Calculus (math)

Abbott, Edwin. (selections from) Flatland

1. Perceptions of "Reality" (3 Dimensionality and the Linearity of Time) Versus a "Reality" Beyond One's Perceptions (philosophy)
2. Science Fiction: Speculative Ideas and Three Dimensional Characterizations (literature)
3. Ritual Persecution: The Psychology of Oppression (sociology-psychology)

Ouspensky, P. D. (selections from) Tertium Organum

1. On the Existence of a Fourth Dimensional Infinite Reality Which We Perceive in Incomplete Finite Three Dimensional Cross Sections: The World of Noumena and Higher Consciousness (philosophy)
2. The Mathematics and Logic Required to "Liberate" Ourselves from the Ordinary Three Dimensional World of Perception (math/logic)
3. Time: The Linear Experience of Time and Other Models for the Abstraction Called Time (philosophy)
4. Linearity in a Mathematical Model: The Cartesian Coordinate System (math)

5. Language and Higher "Realities" (philosophy)
6. The Experience of Infinity (philosophy)
7. Creating a Personal Conceptualization and Model for Infinity (psychology of human potential)

Unit III - Symbolic Logic

Blitzer, Robert. "Introduction to Logic" (article is in three parts)
1. Ways in Which Language Shapes and Molds Our Perceptions Toward Things (philosophy)
2. Group Experience: Labels and Values (psychology of human relations)
3. Lewis Carroll on Language - Alice in Wonderland: Through the Looking Glass (philosophy/mathematics/logic)
4. Politics and the Corruption of Language (sociology)
5. Language and Sexism (sociology)
6. Moving Beyond a Content Language: The Framework for Symbolic Logic--A Language of Form Rather than Content (math/philosophy)

Blitzer, Robert. "The Theorems of Logic"
1. Using the Underlying Symbolic Logic Framework to Prove Theorems (math)
2. The Form of Our Language and the Form of Our Thinking (philosophy)
3. Electrical Networks as a Model for Symbolic Logic (math)
4. Exercises for Dealing with One's Body (psychology of human potential)

Blitzer, Robert. "Validity of Arguments"
1. Definition of a Valid Argument (math)
2. Classical Valid Structures: The Syllogism, Modus Ponens, Modus Tollens (math/logic)
3. Proving Validity Through the Formal Proof (math)

Kupperman, Joel and Arthur McGrade. "Fallacies in Everyday Life"
1. Common Fallacies in Everyday Life (Rather Than Within Formal Abstract Structure) (philosophy/sociology)
2. Examining One's Prejudices (psychology of human potential)
3. The Technique of Role Playing: Role Playing the Fallacies in Everyday Life (psychology of human relations)

Halmos, P. R. "Mathematics as a Creative Art"
1. Math as Art (math/philosophy)
2. Aesthetics: Representative Theories on the Nature of Art (philosophy)
3. Art: Topics for Debate and Discussion (philosophy)

Blitzer, Robert. "The Truth-Value Analysis"
1. The Truth-Value Analysis as an Alternative to the Truth Table for Deciding on the Validity of Arguments (math/logic)

Unit IV - Group Theory

Blitzer, Robert. "Introduction to Group Theory" and Denbow, Carl and Victor Goedicke. "Group Theory and the Postulational Method"
1. The Structure of Group Theory--Unifying Form Encompassing Seemingly Diverse Content (math/philosophy)

2. The Real Numbers (math)
3. Cyclic Groups (math)

Blitzer, Robert. "Group Theory and Algebraic Equations I and II"
1. Theorems of Group Theory (math)
2. Using Group Theorems to Solve Algebraic Equations (math)
3. Form and Content in Art (philosophy)
4. Matrices (math)

Keyser, Cassius. "The Group Concept"
1. Viewing the Mind Within the Group Framework (psychology/math)
2. Another Theory of Time: The Philosophy of the Cosmic Cycle (philosophy)
3. Processing the Experience of Not Understanding on a Personal Level (psychology of human potential)
4. Constructing a Personal Perspective and Model for Time (psychology of human potential)
5. Role-Playing: On Time Disorientation (psychology of human relations)
6. The Complex Number System as a Group Under Addition and Multiplication (math)

Unit V - External Reality and the Inductive Method

Blitzer, Robert. "The Methodology of Straight Thinking"
1. The Research (Scientific/Inductive) Method as a Mode of Inquiry Reflecting Western Philosophic Traditions (science/education/sociology/statistics/psychology/philosophy)
2. Concepts Intrinsic to the Research Mode of Inquiry: null hypothesis, research hypothesis, independent variable, dependent variable, control groups, experimental designs, statistics, statistics of central tendency, statistics of variability, z-score, normal curve, t-value, accept the null hypothesis, reject the null hypothesis at the 5% confidence level, reject the null hypothesis at the 1% confidence level, correlation coefficients, research errors (type I and type II errors), the Hawthorne effect (science/statistics/sociology/psychology/education/philosophy)
3. Ways in Which the Inductive Method Can Produce Useless Results/Distort Collected Data/Reflect Bias of the Experimenter: Things to Watch for When One Uses the Inductive Method as a Mode of Inquiry (science/statistics/sociology/psychology/education/philosophy)
4. The Milgram Study of Obedience: The Vietnam Tragedy (sociology)
5. Ways of Knowing: Contrasting Perspectives Toward the Research Method as a Way of Knowing (philosophy)
6. Skinner and Operant Conditioning (psychology)
7. Considering Oneself in a Number of "Experiments" That Form Part of Our Cultural Conditioning (psychology of human potential)
8. Diminished Expectations and Diminished Performance (psychology)

Blitzer, Robert. "The Computer"

1. The Computer and the Research Method (math/computer science/research)
2. The Computer and Consciousness: Robots: Human Thought--Is it reducible to a logical formalism? Humans and Machines (philosophy/artificial intelligence)
3. Data Processing (math/computer science/research)
4. The Computer and the Invasion of Privacy: Watergate (sociology)
5. Computer Applications (math/research/computer science)
6. Computers as Psychotherapists: An Interview with a Therapeutic Computer (psychology/computer science/philosophy)
7. How the Computer Works (computer science)
8. Ethical Considerations--Computer Power and Human Reason (ethics)
9. A Computer Programmed to Compose Traditional Japanese Poetry (haiku art form)
10. Binary Machine Language--Number Bases (mathematics)

Blitzer, Robert. "The Computational Aspects of Straight Thinking"

1. Final Reiteration of the Theme That Arithmetic is Not Mathematics (math)
2. Computational Formulas and Steps For: The Mean (ungrouped and grouped data), The Median (ungrouped and grouped data), The Mode (ungrouped and grouped data), Standard Deviation (ungrouped and grouped data), the t-test (more than 30 subjects), the t-test (30 or fewer subjects), Chi Square
3. Further Discussion of Other Statistical Tests: The F-test; Correlation Studies
4. The Inductive Method as <u>One</u> Possible Mode of Inquiry (Items 2 through 4; science/education/sociology/statistics/psychology)

How then, does <u>Confluent Math: A Multidisciplinary Thinking-Feeling Approach to Twentieth Century Mathematics</u> develop values unique to humanistic general education? Let us consider those values discussed in chapter 1.

Value 1. Cognitive-Affective Integration

Themes common to twentieth century mathematics and the psychology of human potential enable the MARP product to unify content in areas that appear to be diverse. This would have been more difficult to accomplish if the product had not specifically focused on modern mathematics, an area largely ignored by the high school and college curriculum.

Stated by Dr. Lillian Lieber, in free flowing mathematical verse:

> "But the fact is that
> all the branches of Mathematics
> mentioned in Part I
> had been discovered
> by the time of Newton
> who lived from 1642 to 1727.
> And it was he who
> invented the Calculus.
> Analytic Geometry dates from Descartes,
> about 1637.
> Euclid goes back to
> about 300 B.C.
> And a good deal of the Algebra
> which is studied in
> high school and college
> is spread out
> from as far back as
> about 3000 B.C. to
> the time of Newton.
>
> Thus,
> the knowledge of Mathematics
> of the average college graduate
> stops with what was known
> about 300 years ago!
> And yet
> more Mathematics has been invented
> in the last 100 years
> Than in all the previous centuries
> taken together!"[84]

In short, modern mathematics enables Confluent Math to provide both cognitive-affective thematic integration and develop an area deleted from the curriculum. After all

> "...mathematics [modern math]
> ... is really a domain full of
> DARING
> FANTASY
> IMAGINATION
> FERTILITY
> CREATIVENESS"[85]

and

> "mathematics and FANTASY MAKE
> very good companions indeed."[86]

Thus the nature of this elusive art form guides the curriculum into facets of the whole person deserving study--feelings, fantasy, dreams, decison-making, and value clarification.

Value 2. Increased Personal Awareness and Value Clarification

Numerous excerpted exercises from Confluent Math develop this value--Your Life as a Mathematical Structure, the Autobiographical Awareness, Gestalt Dialogues, and the External-Internal Shuttle. Freedom to choose axioms or personal values along with an awareness of the consequences of these choices is the general bridge between deductive structure and value clarification. Once again Dr. Lieber spells out the general idea enabling the MARP product to provide form for this unique value:

> "Thus you see that in
> both mathematics and art,
> as well as in science,
> there is FREEDOM of choice
> [which]
> CAN SERVE AS A MODEL
> for THINKING about ANYTHING
> whether it be Democracy
> or Censorship
> of whatever."[87]

The "whatever" of Confluent Math is, of course, self in relationship to choosing, developing, and clarifying personal values. Stated by Indian religious teacher J. Krishnamurti, "The Right kind of educator, seeing the inward nature of freedom, helps each individual student to observe and understand his own values; he helps him to become aware of

the conditioning influences about him."[88] This area is given specificity in Your Life as a Mathematical Structure when the student is asked where each value (axiom) in tes list-structure came from, being further asked: Whose life are you living? Whose expectations are you living up to (as reflected in your axioms)?

The notion of creatively authoring one's existence involves moving beyond cultural relatively, spending some time showing students how to decondition themselves. The first step in this process implies an awareness of value-axioms that were programmed but no longer serve a function in terms of present needs of the student. This theme, permeating the MARP product in areas of time, space, language, sexuality, and ways of knowing, adds an aura of controversy to the product. The mathematical notion of the existence of only relative truths takes on a personal perspective through the MARP awareness exercises, philosophically grounded on the assumption that each individual creates tes own subjective infinite universe of values and behavior. Those who believe in the existence of absolutes known only through the authority of others will probably take issue with this second value of general education along with the very nature of mathematics.

Value 3. Interrelationship of Knowledge

A number of areas permit the MARP product to present a multidisciplinary approach to learning. Knowledge is interrelated through themes of creation common to diverse disciplines, ways of knowing, and theories of aesthetics developing perspectives toward the nature of art, placing numerous structures (drama, painting, poetry,

mathematics, group theory, etc.) into aesthetic parameters. This lively multidisciplinary web, integrating areas that presently do not exist in "math books," provides much of the uniqueness to Confluent Math.

At this point the reader should be cognizant of the fact that the interrelationship of knowledge--around structure, aesthetics, ways of knowing, or creative themes--is not an original idea of the MARP. However the idea has never been given the specific direction presented within Confluent Math.

Value 4. Appreciate and Participate in the Creative Process

This value is developed in many of the exercises found in Confluent Math. These exercises, excerpted earlier, include creating a nameless, useless "thing"; constructing personal conceptualizations of time, infinity, and creation; using one's dream journal as a source of creativity; processing (after reading Flatland) one's "craziest" ideas by considering things impossible in external reality that are possible in internal reality. These "strange" creativity experiences, found throughout Confluent Math, parallel the daring fantasy characteristics of an art form more remote from the ordinary than any that has yet to be created by humankind.

Value 5. Acquire Skills Necessary to Function Effectively

In any General Education Mathematics course, most people tend to equate these skills with the ability to carry out computations basic to producers and consumers. Of course we have seen that arithmetic is not mathematics, although the argument whether or not to include

arithmetic in General Education Mathematics wages onward. Obviously the inability to perform basic computations puts one at a distinct disadvantage. However, Confluent Math addresses these skills not in the area of arithmetic but rather in the affective domain.

The area of dreams serves as an illustration. Dreams are important because they give us messages about our waking existence and afford easy access to a different reality. Dreaming is a key to our inner reality. However our education system does very little to give students techniques and skills which enable them to work with dreams in terms of developing further awareness of self. It is hard to imagine how somebody totally cut off from themselves can function effectively (creatively). Thus the dream exercises in Confluent Math are presented as a specific skill to enhance more effective functioning.

Seen in this light, numerous affective experiences excerpted from the MARP product are aimed at developing skills for the attainment of one's full potential. The "Saying No" exercise, for instance, serves as an experience in assertiveness training, reinforced later through a discussion of the Milgram obedience study. It should be pointed out that all the skills in the affective exercises are aimed at the person who is already functioning (not the serious neurotic or borderline psychotic) who wishes to function more effectively and creatively, an aim that is at the heart of the human potential movement.

Value 6. Enables Individuals to Relate More Successfully with Others

This value is developed in Confluent Math through the numerous

group experiences which frequently are filled with conflict, debate and discussion. The process of disagreement, violence and war is examined (through an axiomatic perspective) in one of the exercises. Controversial topics are offered for group debate. The skill of consensus decision making is developed in the "Child of the Future" experience. Role-playing exercises are filled with conflict demanding resolution. The reader should note that in all the excerpted exercises the process of relating more successfully with others is developed around the philosophy of the Gestalt Therapy prayer:

> "I do my thing, and you do your thing.
> I am not in this world to live up to your expectations
> And you are not in this world to live up to mine.
> You are you and I am I..."[89]

Thus the group exercises aimed at this value are based not on one person trying to change another person's value system but on successful relationships based on the acknowledgement of separate subjective universes--a respect for varying axiomatic structures.

Forces that lead to unsuccessful relationships, particularly those involving inhumanity, violence, and holocaust are examined in the exercise "A Need for Ritual Persecution." This discussion item, along with other discussion exercises dealing with human interaction, is intended to serve as a processing device for the actual group experiences.

Value 7. Understand the Scientific Process, Infusing Technology with Genuine Humanness.

This value is developed in an examination of the existential perspective ("Your Life as a Mathematical Structure") and throughout

the final MARP unit ("External Reality and the Inductive Method"). The scientific (inductive) process is developed while simultaneously asking: Is this the only way to know? What components of reality are overlooked by this process? How has this process lead to inhumane research, abused the rights of experimental volunteers, placed technology ahead of genuine human needs? Should limitations be placed on computers despite their technical viability? In short, unit V examines numerous opinions regarding all phases of the scientific process, contrasting the process with the mathematical way of knowing.

Confluent Math is particularly unique in both its extensive development of the induction-deduction interplay and the consideration of moral issues in the scientific process and computer technology. Once again the development of this value leads the product into a consideration of controversial items--marijuana research, political abuse of the computer (an "enemies list"), therapeutic computers, ways that the process can lie, distort, and manipulate. The topic of statistics and statistical computations is developed around the motif of integrating technology with genuinely humane values.

Value 8. Enables Individuals to Experience Joy, Stretch Personal Consciousness

This value is tied in with the idea of teaching students how to transcend cultural conditioning. Considered throughout Confluent Math is the issue of language (as a product of the intellect) locking in perceptions, with the necessity for moving beyond a content language--

beyond the intellect--beyond ordinary consciousness--to experience this job. Extensive literary examples are given by persons who have done precisely this sort of thing, particularly Andrew Weil, Aldous Huxley, and P. D. Ouspensky. The readings are then developed within the exercises around two general categories--exercises that enable individuals to become aware how language, intellect, and perceptions limit the stretching of consciousness and fantasy exercises that begin to enable one to experience different levels of consciousness.

Confluent Math devotes more time to an awareness of forces that limit this "joy" than to an extensive development of techniques permitting one to transcend ordinary consciousness. A complete catalogue of such techniques can comprise a separate volume.[90]

Value 9. Enables Individuals to Understand and Appreciate Philosophies, Life Styles and Accomplishments of Individuals and Groups.

This value is clearly develcped as Confluent Math examines the theories, philosophies, and structures of Euclid, the Pythagoreans, Bertrand Russell, P. D. Ouspensky, E. Galois (group theory), et. al. Many philosophies are very much in contradiction with one another--in fact, the product deliberately presents differing perspectives, raising many questions (the broadest of which is: How does one know?) without c'fering a definitive answer. Thus it is hoped that the reader will begin to appreciate differing philosophies as te extracts those ideas most subjectively of value in examining the question: Who am I?

Value 10. Impetus for Commitment to A Lifetime of Learning

As the reader examined the curriculum designs extant in General Education Mathematics (chapter 1), the idea of a survey of topics and/or perspectives seems to be found in all designs. This is certainly true in the present confluent multidisciplinary approach, surveying a wealth of ideas in the affective and cognitive domains. One aim of the survey is to present a diverse collection of introductory concepts (an introduction to the Gestalt awareness model, mathematical logic, the inductive process, mystical philosophy, and so forth) with the hope of stimulating the reader's appetite to pursue one or more of these concepts in greater detail. This could be done through further readings, raised by issues within the product (students in the experimental sections were given a bibliography for future reading) or by pursuing courses generated by the product. At Miami-Dade North these courses include Introductory Algebra, Symbolic Logic, Statistics, Gestalt Awareness Seminar, Eastern Philosophy, Human Relations, Psychology, or Computer Science. In addition, ideas presented in Confluent Math should parallel and reinforce topics studied in (Miami-Dade's required) Humanities (art, music, drama, philosophy) sequence.

With an overview of the product behind us, we now turn our attention to the results generated by the research design described in chapter 2.

CHAPTER 4

RESULTS AND DISCUSSION

After examining the overview and excerpted exercises presented in Chapter 3, it is hoped that the reader has a feeling for the unique nature of Confluent Math in terms of the unusual multidisciplinary blend of content, the inclusion of experiences that are cognitive and affective, and the unusual style (for a math text) that ties the package together. In this chapter we shall examine the responses of the experimental group which was exposed to the product-course with particular interest focused on the extent to which students perceived the course to be successful (or unsuccessful) in meeting each of the three Confluent Math goals--the mathematical goal, the philosophic goal, and the self-awareness goal.

Chapter 2 indicated the vast bulk of data that were collected to evaluate the product. Basically we have open-ended responses by the students at the end of the course addressing the three goals and the course in general, changes from the beginning of the course to the end (measured in Part 1 by pre-test and post-test) in the categories of math attitudes, math as an abstract art form, resources available to promote self-growth, and attitudes toward school, and finally a comparison between the Confluent Math group and the students who took MAT 201 in the traditional survey curriculum approach.

Before examining the data, two points are in order. In Chapter 1 the MARP author mentioned in passing that students probably would not "flock" to a mathematics course (particularly one not related to vocational aspirations) unless they had to take it to fulfill General Education requirements. This position is reinforced by the literature. Gay Hendricks conducted a survey in which three hundred college students were asked to rank ten subjects in order of interest. The results, ranked from most interesting (1) to least interesting (10), were:[92]

1. Sex and your sexuality
2. Getting high without drugs
3. Communication skills
4. Keeping yourself healthy
5. Death and dying
6. Art
7. Social studies
8. Biology
9. Geography
10. Mathematics

We can note in passing that the areas of greatest importance to students are rarely found in the school curriculum. Of greater significance is the losing position of mathematics. Consequently when students have positive things to say (in terms of attitudes) at the conclusion of a required mathematics course, the significance of their comments should be illuminated by the last place ranking in the preceding list.

The other point which needs to be made concerns the bias of the MARP author regarding data deemed to be most important. Data will be presented in terms of building a reasonable picture of the effects Confluent Math had on the experimental group. In order to

build such a case the data will be given in terms of readability rather than the chronological order in which they were collected. The MARP author took the open-ended responses to the course (in the words of the course participants) to have greater impact than the purely quantitative attitudinal figures (from 1 = negative attitude to 5 = positive attitude), although we would expect the quantitative data to reinforce students' verbatim responses. This, as we shall see, will be the case, although the feeling level behind the attitudes can be seen only by looking at the specifics of what students had to say.

How many students are we talking about? Sixty eight students made up the totality of persons taking the pre-test within the three sections of the MARP author's experimental group. The last day of the course fifty five persons took the post-test. The reader should recall that the pre-test (part 2) assigned every student to one of five area preference types. The breakdown of these results is indicated in Table V:

Table V: Classification of Experimental Section Students by Area Preference

TYPE	FIRST DAY (n = 68)	LAST DAY (n = 55)
Type I (I know, therefore I am.)	n = 28	n = 25
Type II (I feel, therefore I am.)	n = 16	n = 15
Type III (I can deal successfully with and manipulate practical things in the real world, therefore I am.)	n = 15	n = 12
Type IV (I can manipulate and control numbers effectively, therefore I am.)	n = 8	n = 3
Type V (I can work to bring about change in the social/political/economic structure, therefore I am.)	n = 1	n = 0

There are many reasons why people drop a course, sometimes related to external factors rather than something happening within the course. The one Type V person, for example, had to accompany his ailing mother to Northern Florida and was unable to complete the course. However one cannot overlook the relatively large gap between first day and last day for the Type IV people. These were the students who genuinely enjoyed computations and were disillusioned by the non-arithmetic nature of Confluent Math (and mathematics itself). Although the gap is not quite as wide for Type III students, it could easily be conjectured that the abstract fantasy "useless" nature of pure mathematics would clash with people interested in practical manipulation of things in the real world. These initial results point to the value of the part 2 instrument as a future screening device to indicate students whose area preference types would be compatible with the nature of the MARP author's course. Although students would not be refused entry into the course based on their area preference type, they could be given the data from previous groups, counseled regarding other mathematics courses consistent with their needs,[93] and allowed to choose the direction for satisfying their three credit math requirement. We should not be surprised at the low attrition rate among the knowing and feeling people since these were the two areas (What is mathematics? (in conjunction with)How does one know? and Who am I?) emphasized throughout the Confluent Math approach.

We hear over and over that the social and political activism

of the 1960s, fueled by America's involvement in Vietnam, is a thing of the past. At least among the experimental group this appears to be the case with no Type V people present during the last day of the course. Consequently, as we examine the data we shall consider only the 55 subjects within the first four area preference types.

How did these 55 subjects respond to the success of each of the course goals? Table VI indicates a breakdown by number of students within each of the four area preference types responding to the mathematical goal of Confluent Math. The author took each open-ended response collected during the last day of the course and classified them as "quite successful," "moderately successful," and "not successful."

Table VI: The Degree To Which The Mathematical Goal of Confluent Math Was Realized.

Goal: The participant will understand and appreciate logical axiomatic structure (mathematics as an art form).

Numbers of Students Who Responded That:

	Course Was Quite Successful In Terms of Meeting This Goal	Course Was Moderately Successful In Terms of Meeting This Goal	Course Was Not Successful In Terms of Meeting This Goal
TYPE I	n = 17	n = 7	n = 1
TYPE II	n = 9	n = 6	n = 0
TYPE III	n = 4	n = 6	n = 2
TYPE IV	n = 2	n = 0	n = 1

In terms of numbers, since axiomatic structure represents a deductive way of knowing, we should not be surprised that the Type I (I know, therefore I am) students responded positively to this course goal, with only a "moderately successful" categorization by the practical real world (Type III) people. The specifics behind the numbers can be seen by looking at a sample of verbatim responses. Course participants who affirmed that this goal was quite successfully met talked about the appeal of a philosophy-art-math relationship. (Recall that in the survey conducted by Hendricks, art was ranked in sixth position.) These people liked the creative intuitive nature of mathematics, responding again and again that Confluent Math "opened their minds" about mathematical inventiveness. A sample of responses follow (with the area preference type of the respondent indicated in parentheses):

(I) "This part of the course I know has changed my opinion of mathematics. The first day I was ready for computation which has no reflection on the mathematical art form. The distinction of math as a creative art never occured to me let alone its appreciation. So I am sure by fragments of what has been taught in class about the vastness of the Mathematical System and have learned to appreciate that along with other related art systems."

(I) "...I realized that my opinions on math had change. This course has opened my eyes about math."

(I) "...I had no idea that mathematics would relate with philosophic ideas...I appreciate mathematics a lot more than before."

(I) "I gained a lot of knowledge about mathematics being considered an art form."

(I) "I had never realized the creativity and the intuitive ideas necessary to create a mathematical structure...My views have changed drastically from a student with very little understanding of mathematics to a student with greater appreciation and a more open mind."

(I) "I now have a much better and completely different idea about mathematics and its creation."

(I) "I see math as abstract art, not as blah arithmetic."

(I) "I genuinely appreciate mathematics...If another math course is required in my future plans for education I feel I could do much better than if I hadn't taken this particular math course."

(II) "...I certainly can appreciate the inventiveness of a creator of an original theorem."

(III) "...in the beginning I really didn't know what was going on but after a while I really got into it. This course has really opened my eyes to mathematics..."

(IV) "Very successful. Before I took this course I would of never even thought of mathematics being associated with any form of art."

Those persons who affirmed that the mathematical goal was only moderately successful brought out the point that although they now understood the nature of mathematics, they still did not appreciate it. Typical verbatim responses ran as follows:

(I) "I feel that it was somewhat successful. It certainly gave me greater insight into what is mathematics. The only problem is--there was so much material and so little time that I felt rushed to a certain degree."

(I) "...I appreciate it and understand it a bit better...but I still rather do computation."

(I) "I understand the mathematical art form--but I do not appreciate it. I have no complaints--but I just don't like it."

(I) "It was fairly successful. I did relate more to this than I would have a strictly computation class."

(II) "I feel now that math not such a drag but I know that not every math course will be like this."

(II) "I found it very interesting but to tell you the truth I'm so lazy that I left some things behind."

Finally, students who claimed that the mathematical course goal was not a success reported that they preferred the "real" world, complained about being overwhelmed by a vast quantity of reading that they didn't understand, and reported quite openly that they did very little work in the course. All four negative responses are excerpted in the following verbatim replies:

(I) "I did not for the most part enjoyed this course. I believe in the real world regardless of whatever I've heard in this class. Too much material was given for such a short period of time."

(III) "I am majoring in Education; I want to be a French teacher and I don't see any reason why I should take a math course. I don't like mathematics at all."

(III) "...you would have to read the article several times and still not understand."

(IV) "not successful since I put very little work in this class."

Table VII parallels Table VI, this time dealing with the philosophic goal of Confluent Math.

Table VII: The Degree to Which the Philosophic Goal of Confluent Math Was Realized

Goal: The participant will examine major philosophic ideas that relate to the creation of axiomatic structure along with the broader question--How does one know?

Number of Students Who Responded That:

	Course Was Quite Successful In Terms of Meeting This Goal	Course Was Moderately Successful In Terms of Meeting This Goal	Course Was Not Successful In Terms of Meeting This Goal
TYPE I	n = 18	n = 4	n = 3

TABLE VII (cont'd)

TYPE II	n = 7	n = 6	n = 0
TYPE III	n = 4	n = 6	n = 3
TYPE IV	n = 1	n = 2	n = 0

Again there is a consistency between area preference types and the area (ways of knowing) addressed by this course-product goal. For the knowing people (Type I) the course was regarded as highly successful. This number diminishes among the feeling people (Type II) and is much lower among the practical real world students (Type III) who had difficulty relating Ouspensky's World of Noumena, non-linear models of time, etc. to the everyday world about them. It is difficult based on only three persons to make a definitive statement on Type IV responses to this goal, but we could hypothesize that students interested in computational procedures might be somewhat less than thrilled at philosophic ideas, even if these raised issues such as "What is a number?". This hypothesis gains momentum when we remember that five Type IV people dropped the course, giving us a very small remaining sample to generalize from. It would have been ideal to follow up on course participants who withdrew, but since Miami-Dade Community College no longer requires the signature of an instructor in order to withdraw from a course, many of these people simply vanished from sight.

Students who labeled the philosophic goal as "quite successfully" met talked about the interesting exposure of unusual ideas that resulted in their own broadening and growth. Typical replies included:

(I) "It was interesting and the readings were great."

(I) "Very successful. I could never have placed so much value on fantasies and internal reality. Before taking this course that was a place for 'crazy' people only. I did have fantasies before the course but fantasy world was not considered the best place to be."

(II) "It was enlightening and I was exposed to a lot I would never have been in another class. Enjoyed the readings and was surprised at your point of view."

(II) "I have learned to accept my ambivalences instead of always thinking in the either-or concept."

(III) "This area was the most broadening. For a while I was very messed up by this part of the course. I tried to stay open... and I am very pleased with the results. I think I've grown and I feel more definite of who I am."

The students who felt that the philosophic course goal was only moderately met stated that some ideas which were initially of interest began getting too repetitious, that they personally took offense at various philosophies, and that the philosophies supporting the nature of mathematics got to be too one-sided. (This bias was found in the initial reading, The Natural Mind, although differing perspectives for knowing were presented throughout the course. A specific instance of this involves the clash of ideas between the mystic P. D. Ouspensky and the logician Bertrand Russell.) Typical student responses were generated along the following lines:

(II) "I found the material exciting in terms of ideas, but it began to get boring due to repetition of specific topics."

(II) "I don't agree with everything but you made me aware there is more to math."

(III) "The course was successful at least in making me aware of these areas. However, I thought it was a little bit one-sided--i.e., nonordinary thinking in positive terms and ordinary thinking in negative terms."

The negative responses to the philosophic course goal were based on the notion that the philosophic ideas were not understood or really didn't belong in a General Education Mathematics class.

(I) "I still don't understand what all that is about."

(I) "I didn't understand it."

(III) "I really thought I was going crazy hearing about the different therapies and philosophies."

(III) "I think philosophies like this do not belong in a General math class. Would definitely be good for a major of math."

The final course goal dealing with the domain of self-awareness is addressed, in terms of number, in Table VIII.

Table VIII: The Degree to Which the Self-Awareness Goal of Confluent Math Was Realized

Goal: The participant will use goals (1) and (2), in conjunction with techniques grounded in the Gestalt therapy model of Dr. Frederick Perls, to gain increased awareness of tes existence.

Number of Students Who Responded That:

	Course Was Quite Successful In Terms of Meeting This Goal	Course Was Moderately Successful In Terms of Meeting This Goal	Course Was Not Successful In Terms of Meeting This Goal
TYPE I	n = 20	n = 3	n = 2
TYPE II	n = 13	n = 2	n = 0
TYPE III	n = 5	n = 4	n = 3
TYPE IV	n = 1	n = 1	n = 1

On a number (percentage) basis, the feeling Type II people obviously enjoyed (and found successful) this aspect of the course dealing with the affective component of self. The knowing Type I students also responded positively, with a much higher percentage of Type III persons claiming that the self-awareness goal was only moderately or not at all successful. In short, data collected thus far indicate that although a substantial percentage of Type III and IV persons responded affirmatively to the course goals, all goals were quite successfully met by a very high percentage of Type I and II people, the groups with a very low course attrition rate.

A frequent response among people who claimed the self-awareness aspect of the course was successfully met involved being able to express (through writing) feelings that they had previously bottled inside. Students who experienced a particular conflict that arose while they were taking MAT 201 also found the awareness techniques to be self-therapeutic. In the following chapter we shall consider excerpts of a representative sample of responses to the awareness alternatives, hopefully providing the reader with a feeling for the directions pursued by participants in relationship to this course goal. At this point, we consider some typical verbatim responses from students who saw the self-awareness course goal as successfully realized:

(I) "Seeing it [awareness project] written down didn't change my feelings, but it did give me some new food for thought."

(I) "It gave me a different way to let myself go which I used at the end of the course because of a death of a friend."

(I) "I honestly think this is the course that helped me understand myself the most, from all the courses I've taken in MDCC and I graduate next term."

(I) "This did a lot for me personally...because it let me do something I haven't done and that is express my inner feelings..."

(I) "The class has helped me gain a greater awareness of myself as a person. I thank you for that!"

(I) "...I said a lot of things I would not ordinarily say and this was a great help."

(I) "The technique of topdog-underdog was good in helping myself..."

(I) "I enjoyed this section most because it dealt with self."

(I) "The awareness project was a hard one for me to do, but it help me get some of the pain I had inside and by writing it I felt a great relief...I wrote things I had never told anyone."

(I) "Self dialogues seem to be important in all my decision making now."

(II) "This was the most successful. It enabled me to tune in to me. We talked many times in your office."

(II) "I hope you don't think I'm putting you on, but I learned more from this than I can thank you for. The awareness project I turned in was real, and a very feeling experience for me. I learned a lot of things about me. I felt really good after I wrote it. It was like I released something that I never released before. I really didn't even care that much about the grade after that. The thing that really mattered was how my feelings about myself changed. My life will not change drastically because of it, but somehow, I feel better now."

(II) "I find myself using them [awareness techniques] on me all the time."

(II) "It was quite enlightening...I became more aware of topdog/underdog compoments and begin to reevaluate my values and beliefs and ideas."

(II) "This part of the course made me aware of why I left home."

(II) "It was a very beautiful learning experience and I will miss it."

(II) "I love to try all the techniques."

(III) "The course helped me find things that could help me as an individual and to direct myself to see how I am and want to be."

(IV) "Extremely successful and looked at some parts of myself that I did not want to see. I met my enemy head-on and can deal with it."

Students who responded that the course goal was only moderately successful by and large echoed the notion that they enjoyed the awareness portion of the course, but that there was not enough of it. The MARP author sees this as a legitimate complaint, perhaps inevitable in our ambitious attempt to integrate an interdisciplinary survey of math, philosophy, and the psychology of human potential. More time could have been devoted to any single area of the course only if the Confluent Math product were used in a class worth more than three credits. The issue of a six to nine credit course, developing the three course goals in greater depth, will be discussed in our concluding chapter. For now we turn to a sample of "moderately successful" responses:

(II) "It was successful but I would have liked more."

(III) "You only spent a class and a half demonstrating dreamwork techniques. I had about five dreams after that which I wanted to work on in class and we were up to something new."

(III) "You should have shown more Fritz Perls' films. I felt safer watching people working on screen than I did with the live demonstrations in class."

(IV) "I think my awareness project gave me new insights but I really need a few semesters to decide this for sure."

Gestalt awareness techniques, involved with artificial procedures like dialoguing among exagerated components of self, giving parts of a dream a voice, and using fantasy to gain increased awareness of one's

existence, are not intended for everyone. Some people simply cannot "get into" the techniques. Others feel very threatened by the direct encounter (with self) aspect of the system, preferring to talk about themselves and attain a sort of safe intellectual detachment. Some students taking MAT 201 did not want to deal with feelings, choosing instead to shut them in. These sorts of ideas were found in the responses by students who said that the self-awareness course goal was not successful:

(I) "Gestalt was interesting but...not effective for me."

(II) "This was the least successful area, because I was aware of these areas and therefore already pretty much aware of where I was (am) existentially in the beginning of the course."

(III) "I tend to shut in my feelings therefore I have fears in releasing them."

(III) "I found this part of the course interesting but I had the attitude, 'Keep this stuff away from me.' I didn't mind hearing about it but I didn't want to participate."

Finally, on the last day of the course, after responding to the success (or lack of it) of the three course goals, students were asked if they had any additional comments concerning the Confluent Math course-product. Certain comments seemed to come up again and again. One complaint dealt with the vast amount of material in the course. Many students liked the class because it was so "different"--like nothing they had ever seen. This is probably the case since, to the knowledge of the MARP author, nothing like Confluent Math exists within the pages of a single volume. Numerous participants had positive things to say about the course instructor, leading to the conclusion that the influence of the instructor as an independent variable of the study cannot be negated. We shall come back to this

idea in our concluding remarks in chapter 6. For now we turn our attention to a sample of excerpted responses to the additional comments students made about the course:

(I) "...the second half was easier and clear"

(I) "The course is too full--I think the only reason the class was so interesting was because of the instructor. To explain something so complicated and outrageous you need an outrageous person full of vitality and enthusiasm."

(I) "I think if you had taught me when I was younger I could of really gotten into it..."

(I) "Everything about the course stimulated freedom and awareness... I will help others to know of things I previously thought didn't exist."

(I) "I enjoyed the course as it was like nothing I ever had."

(I) "Thanks for the insight on both mathematics and myself."

(I) "No bullshit now! Your course was by far the most different and greatest learning experience for me. I thought it was brilliant of you to combine 3 disciplines in a General Education Math course...I"m sorry you weren't around during my high school years."

(I) "I think you're one of the best teachers I've had here in Miami...You make things very clear."

(I) "You try to put too much across in one course."

(I) "You talk too much."

(I) "Readings that kind of turn people off especially if you hate reading."

(I) "Bob has really put a lot into this course. He has been so explicit as an instructor. For my personal anxieties he made me feel very relax which was very necessary for me to absorb a math course."

(I) "Some of the reading were interesting and others were long and boring."

(I) "This course has made me more aware of my own inner existence. Thank you."

(I) "I don't think the course would be successful if you weren't teaching it."

(II) "Your mind amazes me! Your one of the few teachers I trully respect. You always seemed to spice things up one way or another."

(II) "This was by far one of the most interesting courses I've taken anywhere. Bob you're really into this and it shows. You really have it together."

(II) "There were too many readings for the length of the class."

(II) "I would have like more straight [traditional] math."

(II) "This course at times became a trip, a boring experience, an enlightening experience, a learning experience, at times quite humorous, but overall I liked it. You're a great instructor, warm, understanding, at times a little weird but I still admire and respect you."

(II) "...I do feel the student should be aware of what he's getting into before signing up for the course. "

(II) "I enjoyed the course immensely...the instructor is a very beautiful person and a wonderful instructor and very learned. He reminds me of my son Gary."

(II) "There should be more time for experimenting with new therapies."

(III) "Because you were younger than the overall prof. I seemed more at ease in the class."

(III) "I really enjoyed your course and I have recommended it to many people.

(III) "I enjoy dreamwork demonstrations and fantasy work better than the logic."

(III) "The class was conducted beautifully."

(III) "I liked the course, although at first I thought it was something crazy."

(III) "I loved this class. I loved your teaching style. The readings were great. One thing really bothered me. In the beginning of the semester you said 'religious mythology' and I found that very offensive. Thanks for the class Bob."

(IV) "Bob Blitzer is the best instructor that I ever had. He loves to teach, he never rejected a question from any student and I am

grateful to have been lucky enough to have been his student. He helped me a lot on his own time--extra work means nothing to him."

(IV) "Your sense of humor made the class great."

In short, the non-quantitative data presented thus far indicates the success of the Confluent Math course-product in terms of meeting the stated goals of the class. We would expect subsequent data to reinforce and provide specificity to those results that have already been elicited. This will indeed be the case as we examine the quantitative aspects of the research.

The reader will recall that on the first day of the course students took a 23-item pre-test measuring attitudes in four categories. Internal reliability, measured by coefficient alpha, turned out to be relatively high on two of the categories (math attitudes and attitudes toward school) but rather low on another two categories (understanding the nature of mathematics as an abstract art form and having resources available to promote self-awareness). The Department of Testing and Research at Miami-Dade Community College North suggested two alternatives. One simply involved eliminating those items from the pre-test that did not have a high correlation with other items in a category. This would be easy enough but a few items that generated data which could be evaluated in light of the non-quantitative data would have to be eliminated. The second alternative, the one recommended by the Testing and Research Department, involved considering the pre-test as four separate instruments, retaining all questions within each instrument. Two of the instruments, then, would have low internal reliability, resulting in exaggerated

t-values when comparing pre-test and post-test results. However, since the research design was set up in a way that the verbatim student responses pretty much indicated the success of the Confluent Math product, and since this part of the research would simply reinforce that which was already known, it was suggested that the MARP author retain all questions, examine the possible reasons for low internal reliability on two of the instruments, take this into account when looking at t-values, considering numerical results in light of verbatim responses and the awareness projects presented in chapter 5. If these questions had been the sole method of course-product evaluation, the MARP author would have eliminated items with low category correlation, but even these items will turn out to be interesting (in terms of why they didn't correlate) and provide an evaluative picture not possible if they had been eradicated. Thus we turn our attention to the results of the four instruments previously referred to as part 1 of the pre-test.

Table IX indicates the results of the Category A pre-test for the experimental group. We can see a high internal reliability for this short instrument, although many of the items in the inter-item correlation matrix just barely "miss" being significant at the 5 percent level. Items designated by * indicate those in which the scoring has been reversed.

TABLE IX: Results of the Pre-test Items for Category A[94]

Category A: Math Attitudes

*1. I wish I didn't have to take this math course.
*4. I have a mental block about mathematics.
6. I enjoy mathematics.
15. I appreciate mathematics.
*21. Mathematics makes me feel inadequate.
*22. Indicate the grade you are likely to receive on a mathematics exam.

ITEM NUMBER	MEAN	STANDARD DEVIATION	CORRELATION WITH CATEGORY (Minus Item)	CORRELATION WITH PART I OF INSTRUMENT (Minus Item)
1*	3.05	1.30	.69	.44
4*	3.20	1.41	.60	.45
6	2.85	1.18	.63	.56
15	3.56	0.76	.36	.24
21*	3.35	1.17	.65	.61
22*	3.40	0.95	.51	.47

Inter-Item Correlation Matrix

	1	4	6	15	21	22
1	1.00	.55	.59	.49	.52	.36
4	.55	1.00	.49	.07	.61	.42
6	.59	.49	1.00	.38	.45	.42
15	.49	.07	.38	1.00	.25	.22
21	.52	.61	.45	.25	1.00	.50
22	.36	.42	.42	.22	.50	1.00

Coefficient alpha = .817 (Internal Reliability)

Despite the high internal reliability, it is interesting to note that item 15 (I appreciate mathematics) has the lowest correlation with the category and, of course, fairly low correlations with the other questions. How do we account for such a relatively positive initial mean (remember that a high score represents a positive attitude) for this item? The Wellesley-Wesleyan Math Project, funded for 1976-78 by the Fund for the Improvement of Post secondary Education, centers its work around a condition called "math anxiety." Part of this condition involves awe and appreciation over this "thing" that mathematicians do, the notion that "mathematical apptitude is inborn and granted to a few geniuses,"[95] and a self-concept radically differing from the math stereotype. Who wouldn't appreciate this marvelous genius-type activity which exists outside of self, while "self" may feel anxious, fearful, stupid, embarrassed, and defective about the subject? Thus one can appreciate mathematics while still perceiving oneself as inadequate, with having a personal mental block about the subject, and personally not enjoying it. Wellesley-Wesleyan uses Gestalt techniques, in which clients sit in one chair as a person taking math and in another chair as a person not taking math, encouraging students to talk about how they feel in the two chairs.[96] The most plausible explanation for item 15 seems to involve components of "math anxiety."

Table X indicates the pre-test instrument with the lowest internal reliability. Once again, items designated by * involve reverse scoring, with a high score representing a positive attitude.

Table X: Results of the Pre-test Items for Category B[97]

Category B: Understanding the Nature of Mathematics as an Abstract Art Form

*2. Arithmetic computation is essentially what mathematics is all about.
*5. Mathematics is a complete system where everything can be proved true or false.
*8. Mathematics deals primarily with a description of situations and things in the real world.
11. Mathematics is related more to philosophy or art than it is to science.
*16. Mathematics involves learning certain procedures and applying them to solve problems, rather than true artistic creativity.
19. I have a good idea of what mathematics is.

ITEM NUMBER	MEAN	STANDARD DEVIATION	CORRELATION WITH CATEGORY	CORRELATION WITH PART I OF INSTRUMENT
2*	2.98	1.08	.15	-.20
5*	2.69	1.32	.24	-.01
8*	3.27	0.99	.07	.14
11	2.27	1.13	.13	-.23
16*	2.16	0.74	.15	-.01
19	3.44	0.92	-.26	.22

Inter-Item Correlation Matrix

	2	5	8	11	16	19
2	1.00	.24	.02	.00	.14	-.10
5	.24	1.00	.15	.18	.28	-.32
8	.02	.15	1.00	.05	-.09	-.03
11	.00	.18	.05	1.00	.12	-.06
16	.14	.28	-.09	.12	1.00	-.19
19	-.10	-.32	-.03	-.06	-.19	1.00

Coefficient alpha = .19 (Internal Reliability)

The real "problem" item involves number 19 (I have a good idea of what mathematics is). By the wording of the item, students with any preconceived notion as to the nature of mathematics (whether as defined in Confluent Math or falling into the stereotype that math is arithmetic) would score highly on this item, with results indicating that many students on the first day thought they knew what mathematics was. If we compare this result with the already presented verbatim responses ("I see math as abstract art, not as blah arithmetic") and the low negative correlations between items 19 and 8, 19 and 11, and 19 and 16, we realize that students are responding in terms of strongly held prejudices about the nature of mathematics. Although this lowers internal reliability dramatically, it also gives further significance to the change of attitude that many students experienced between the first day and the final day of the course. The relatively high mean and low standard deviation on item 8 also indicates the degree to which students' perceptions changed as they eventually saw mathematics as an internal abstract creation of the artist. We shall later examine the quantitative aspect of this change when we look at t-values.

The (now) separate instrument whose results are presented in Table XI also has a low internal reliability, although somewhat higher than that for Category B.

Table XI: Results of the Pre-test Items for Category C[98]

Category C: Having Resources Available to Promote Self-Growth and Self-Awareness

3. When I have personal problems or conflicts, I know a number of techniques which I can use to work things out.
13.* I do not know many techniques that I can use in order to discover more about my feelings and with which I can gain greater self-awareness.
14.* Many of the things in my background really messed me up.
20.* I feel that nothing, or almost nothing, can change the opinion that I currently hold of myself.

ITEM NUMBER	MEAN	STANDARD DEVIATION	CORRELATION WITH CATEGORY	CORRELATION WITH PART I OF INSTRUMENT
3	3.87	.94	.28	.28
13*	3.49	1.20	.25	.19
14*	3.84	1.32	.38	.20
20	3.22	1.24	-.07	-.11

Inter-Item Correlation Matrix

	3	13	14	20
3	1.00	.38	.33	-.18
13	.38	1.00	.27	-.12
14	.33	.27	1.00	.10
20	-.18	-.12	.10	1.00

Coefficient alpha = .361 (Internal Reliability)

The relatively high correlations between items 3 and 13 should be expected, although if one carefully reads the two questions one might expect a much higher correlation. A possible explanation involves the use of the phrase "personal problems" in question 3. Many people have conceptualizations of therapeutic techniques within a Freudean framework--that is, techniques for deeply disturbed non-functioning persons. Abraham Maslow's humanistic model, philosophically consistent with the self-awareness component of Confluent Math, involves techniques for people who are already functioning relatively well who wish to do so even more creatively. The Maslow model is elicited more by the wording of item 13 than item 3.

Item 20, correlating negatively with the category-instrument, indicates that regardless of perceptions involving techniques for self-growth, changing one's self opinion is so much broader than working on a particular conflict or problem that there is virtually no correlation. Indeed, later results will indicate that although significant changes occurred on item 13, the totality elicited by question 20 did not significantly change over the duration of the course. Techniques available for self-awareness are not the same thing as changing one's basic self-concept.

Finally, the instrument in Table XII indicates a substantially high internal reliability for a six-item questionnaire.

Table XII: Results of the Pre-test Items for Category D[99]

Category D: Attitudes Toward School

7. On the whole, I am satisfied with my work in school.
*9. I frequently feel ill at ease in class.
10. Generally speaking, I'm a pretty good student.
*17. School is a real drag.
*18. Even when I don't understand something, it's hard for me to ask the teacher a question.
*23. Indicate the overall average you are likely to have after four years of college.

ITEM NUMBER	MEAN	STANDARD DEVIATION	CORRELATION WITH CATEGORY	CORRELATION WITH PART I OF INSTRUMENT
7	3.38	1.34	.41	.15
9*	3.49	1.25	.47	.23
10	3.93	.79	.06	.11
17*	4.15	.89	.40	.17
18*	3.49	1.35	.48	.40
23*	3.93	.54	.38	.47

Inter-Item Correlation Matrix

	7	9	10	17	18	23
7	1.00	.32	-.01	.34	.33	.24
9	.32	1.00	.17	.32	.35	.27
10	-.01	.17	1.00	-.20	.09	.16
17	.34	.32	-.20	1.00	.40	.22
18	.33	.35	.09	.40	1.00	.28
23	.24	.27	.16	.22	.28	1.00

Coefficient alpha = .63 (Internal Reliability)

We previously suspected, based on item 15 in Table IX, that a degree of "math anxiety" was initially present within the experimental section. Donady, Kogelman, and Tobias claim that anxiety and fear over mathematics is linked to academic achievement in general and to one's overall attitude toward school.[100] It should be obvious that the items listed in Table XII are not related directly to the three general goals of Confluent Math, but it will be interesting to see if any of the items measured by the instrument changed significantly at the end of the course with the dissipation of some negative attitudes toward mathematics.

The reader might be somewhat confused by the almost-zero correlation of item 10. The MARP author was somewhat at a loss to explain this, so after students in the experimental sections had completed their post-tests on the last day he asked the three sub-sections about this puzzling non-correlation. A relatively large number (n = 24) of students said that they "strongly agreed" or "agreed" with being a good student out of the fear that if they rated themselves lower they would initially create a negative impression in the mind of the course instructor. This might, in turn, affect their grade. Although directions given with the pre-test involved the usual "be honest; there are no right or wrong answers; this has nothing to do with your course grade," students were obviously concerned with creating a good first impression.

Before discussing the changes that took place from the pre-test to the post-test on all questions making up the four instruments, we have included an inter-category (or inter-instrument) correlation

matrix for the overall pre-test. Table XIII indicates the internal reliability resulting from fusing the four instruments into a single part 1 pre-test.

Table XIII: An Inter-Category Correlation Matrix for the Pre-Test

Category	Mean	Standard Deviation
A	19.42	4.98
B	16.82	2.79
C	14.42	2.77
D	22.36	3.80
Overall Part I	75.58	8.57

Correlation Matrix

	A	B	C	D	OVERALL
A	1.00	.11	.13	.08	.79
B	.11	1.00	-.34	-.18	.21
C	.13	-.34	1.00	.37	.45
D	.08	-.18	.37	1.00	.55
Overall	.79	.21	.45	.55	1.00

Coefficient alpha = .659 (Internal Reliability)

We are now ready to consider the changes that took place in terms of the four categories measured by our instrument. Table XIV compares the pre-test and post-test scores for the experimental group on categories A, B, C, and D, in addition to giving an overall attitudinal change t-value.

Table XIV: A Comparison Between Pre-Test and Post-Test Part I Scores. (By Category)[102] (n = 55)

CATEGORY	MEAN (Pre-Test/ Post-test)	STANDARD DEVIATION (Pre-test/ Post-test)	T-VALUE
A - Math Attitudes (1*,4*,6,15,21*,22*)	19.42/22.15	4.98/3.73	4.33
B - Understanding the Nature of Mathematics as an Abstract Art Form (2*,5*,8*,11,16*,19)	16.82/23.13	2.79/3.10	11.82
C - Having Resources Available to Promote Self-Awareness (3,13*,14*,20*)	14.42/15.27	2.77/1175	2.12
D - Attitudes Toward School (7,9*,10,17*, 18*,23*)	22.36/23.18	3.80/3.61	1.59
Overall	75.58/86.53	8.57/8.35	9.28

Remembering that instruments B and C had relatively low values for coefficient alpha (leading to large t-values), we can nevertheless see how Table XIV quantitatively verifies verbatim student responses. We can be 99 percent sure that the product-course-instructor interplay caused a significant upward change in attitudes in both math attitudes and understanding the nature of mathematics as an abstract art form. With 95 percent certainty we affirm that the independent variables caused an upward change for the experimental group in the area of having resources available to promote self-awareness. Even though we cannot reject the null hypothesis at the 5 percent level in relationship to attitudes toward school (Categroy D), we can still observe a

dramatic upward shift in this area. Since the Confluent Math product did not directly deal with this area as an explicit topic, what explanations can be offered for this substantial increase?

In terms of previous discussion, researchers of "math anxiety" have found that this condition generalizes dramatically to one's entire academic attitude. With the dissipation of "math anxiety" (measured by the significant attitudinal increase in Category A), we would expect a more positive relaxed academic attitude. The obviously positive experience that students had in MAT 201 seems to have had an affect on their outlook toward education. We must also consider when data were collected for Category D. The pre-test was taken before a word about the course philosophy was mentioned--before the instructor introduced himself--during the first part of an initial meeting where students (in any course, but particularly last-ranked mathematics) would naturally be somewhat anxious. The post-test was given after all course work had been turned in--during a relaxed final day in which the course closure, the now-developed closeness of teacher-student bonds, the atmosphere of mutual trust, etc., came into play, eliciting more of a feeling of self-confidence that may indeed reflect itself in a generally good-feeling about school.

Of course Table XIV indicates attitudinal changes within the four general categories. It is necessary to consider the specifics behind these upward shifts by examining the individual items making up the instruments. This is indicated within Table XV. The reader should observe that scores in Table XV are not reversed, since the computation of the absolute value of t did not necessitate this reversal. (Within

Table XIV scores had to be reversed in order to consider the shift in overall categories.) Consequently items designated by *, the negatively worded items, will reflect pre-test post-test mean scores that are getting lower. The reader should keep in mind that a lowering of attitude over a negatively worded item is tautologically equivalent to an upward attitudinal change.

TABLE XV: A Comparison Between Pre-test and Post-test Part I Scores (By Item)[103] (n = 55)

ITEM ON PART 1 OF PRE-TEST AND POST-TEST	MEAN (Pre-test/ Post-test)	STANDARD DEVIATION (Pre-test/ Post-test)	T-VALUE (in absolute value)
1* I wish I hadn't taken this math course.	2.95/1.82	1.30/.84	5.85
2* Arithmetic computation is essentially what mathematics is all about.	3.02/1.77	1.08/1.02	6.57
3 When I have personal problems or conflicts, I know a number of techniques which I can use for working things out.	3.87/3.96	.94/.98	.57
4* I have a mental block about mathematics.	2.80/2.29	1.41/1.08	2.25
5* Mathematics is a complete system where everything can be proved true or false.	3.31/1.96	1.32/1.15	6.02
6 I enjoy mathematics.	2.85/3.35	1.18/1.11	3.07
7 On the whole, I am satisfied with my work in school.	3.38/3.56	1.34/1.26	.92
8* Mathematics deals primarily with a description of situations and things in the real world.	2.73/2.20	.99/1.24	2.54

9*	I frequently feel ill at ease in class.		
	2.51/2.18	1.25/1.12	1.84
10	Generally speaking I'm a pretty good student.		
	3.93/3.91	.79/.87	.13
11	Mathematics is related more to philosophy or art than it is to science.		
	2.27/3.69	1.13/1.12	6.74
12	My background in mathematics is pretty good.		
	2.56/2.80	1.27/1.30	1.42
13*	I do not know many techniques that I can use in order to discover more about my feelings and with which I can gain greater self-awareness.		
	2.51/2.04	1.20/1.12	2.26
14*	Many of the things in my background really messed me up.		
	2.16/2.02	1.32/1.06	.85
15	I appreciate mathematics.		
	3.56/3.69	.76/1.02	1.04
16*	Mathematics involves learning certain procedures and applying them to solve problems, rather than artistic creativity.		
	3.84/2.38	.74/1.23	8.02
17*	School is a real drag.		
	1.86/1.95	.89/1.16	.50
18*	Even when I don't understand something, it's hard for me to ask the teacher a question.		
	2.51/2.31	1.35/1.29	.98
19	I have a good idea of what mathematics is.		
	3.44/3.75	.92/.99	1.72
20*	I feel that nothing, or almost nothing, can change the opinion that I currently hold of myself.		
	2.78/2.64	1.24/1.48	.68

21*	Mathematics makes me feel inadequate.		
	2.66/2.44	1.17/1.01	1.24
22*	Suppose that you just got back a mathematics examination. Which grade are you likely to receive on this exam?		
	2.60/2.35	.96/.84	1.88
23*	Suppose that you just completed four years of college. Which grade do you think would best reflect your overall average for four years of college courses.		
	2.07/1.84	.54/.63	2.75

Let us briefly consider items over which we cannot reject the null hypothesis at even the 5 percent confidence level. In relationship to Category A only items 15 and 21 did not change significantly. Item 15 was previously discussed with the so called "appreciation" related to the same values that the lay person has toward Einstein's relativity theory--I appreciate this because it is so complex and obviously incomprehensible to (worthless) me (worthless, at least, in comparison to Einstein!). Consequently the initial appreciation that surfaced during the pre-test (with some question as to whether this was really appreciation; after all, students later indicated that they didn't even know what mathematics was, so one wonders what they were appreciating) had a tendency to mask what was still an obvious upward trend. Item 21 also did not change significantly although there is a low initial score which did change somewhat.

The high t-value in category B is indicated by the 99 percent significant change in attitude on questions 2, 5, 8, 11, and 16 and a 95 percent significant change on item 19.

Although some of the items making up Category C did not change

significantly, there are still interesting upward shifts. Item 14 indicates a degree of internalization of the Gestalt existential perspective, with less blaming of the past and more active responsibility for one's authored chosen existence. Item 13, significant at the 99 percent level, shows that students did acquire awareness techniques which they obviously did not consider equivalent to techniques for dealing with "problems" (see item 3). Again the pathological implications of "problems," an issue previously discussed, seems not to be present within the jargon of humanistic psychology (self-growth; self-awareness).

The encouraging (but not significant) change measured by Category D is reflected in the Table XV breakdown. There are more positive attitudes toward school work (item 7) and ease in asking questions in class (item 18), although these changes are not statistically significant. The feeling of being at ease in class did change significantly (item 9; reject null hypothesis at 5 percent confidence level) and with 99 percent certainty item 23 indicates that the fantasy of how students thought they would do over four years of college courses increased. This result is not consistent with the lowest of our t-values in item 10, but this was the question that students later indicated they initially answered more positively than how they really felt in order to create a good first impression.

The MARP proposal dealt with the author's expectations that attitudinal changes would occur, but frankly he did not expect the data (both quantitative and verbatim responses) to be so dramatically supportive in terms of the direction of the project. For this reason

the expectation that there would be significant attitudinal differences among Types I, II, III, and IV occurred only in Category C. For other categories, an analysis of variance indicated that the impact of the Confluent Math product-course outweighed initial areas of preference (at least at a highly significant level). These results are shown in Table XVI.

Table XVI: Summary of the Analysis of Variance for Categories A Through D for Groups I Through IV.

Category A: Math Attitudes

	MEAN	STANDARD DEVIATION
Preference Type I(n = 25)	21.60	3.99
Preference Type II(n = 15)	22.73	2.92
Preference Type III(n = 12)	21.75	4.12
Preference Type (V (n = 3)	25.33	3.22

Source of Variation	SS	df	MS	F	P Less than
Between Groups	44.99	3	14.99	1.08	.366
Within Groups	707.85	51	13.88		

Category B: Understanding the Nature of Mathematics as an Abstract Art Form

	MEAN	STANDARD DEVIATION
Type I	23.80	3.04
Type II	22.80	2.62
Type III	22.08	3.80
Type IV	23.33	2.89

Source of Variation	SS	df	MS	F	P Less than
Between Groups	26.13	3	8.71	.90	.448
Within Groups	493.98	51	9.69		

Category C: Having Resources Available to Promote Self-Growth and Self-Awareness

	MEAN	STANDARD DEVIATION
Type I	15.80	1.50
Type II	15.47	1.69
Type III	13.67	1.61
Type IV	16.33	0.58

Source of Variation	SS	df	MS	F	P Less Than
Between Groups	41.84	3	13.95	5.78	.002
Within Groups	123.07	51	2.41		

Category D: Attitudes Toward School

	MEAN	STANDARD DEVIATION
Type I	23.28	3.21
Type II	23.13	3.80
Type III	23.08	3.55
Type IV	23.00	7.55

Source of Variation	SS	df	MS	F	P Less Than
Between Groups	.49	3	.164	.012	.998
Within Groups	701.69	51	13.76		

We see that the course goal involving self-growth (self-awareness) had significantly more impact on the knowing and feeling people than on the persons interested in practical things in the real world. Because of the small number of Type IV persons, it is difficult to draw

conclusive statements regarding their (surprisingly) high Category C mean score.

In short, the Confluent Math product had more than its expected impact in the areas of math attitudes, math as an art form, self-awareness, and (generalizing to) attitudes toward school. At this point the reader may wonder about what kinds of results were elicited from the control groups. Perhaps they, too, experienced these across-the-board positive feelings in relevant areas. We say relevant areas because the traditional MAT 201 course could only be compared with the experimental section in Categories A and B.

The fifty five students from whom data was collected represented all people who were present in the experimental sections of MAT 201 on the last day of the course--in other words, students who had not withdrawn from the course. Final grades earned by this group ran the gamut from A to F (A = 12 students, B = 20, C = 18, D = 3, F = 2). In terms of the overwhelming positive response elicited thus far, the MARP author decided to stack the decks against himself by only including students with a final grade of C or better in the control section.

In Chapter 2 we indicated that eighty copies of the instrument appearing in Appendix C were mailed two weeks after the conclusion of the Fall 1976-1977 term to all Miami-Dade North students who had completed MAT 201 (minimum grade: C) during the Fall term in a daytime section of the course. Fifty-one copies of the compieted questionnaire were returned to the MARP author, with results shown in Tables XVII and XVIII. Once again, we have not reversed scoring in Table XVIII so that a lower score for* (negatively worded) items indicates a more positive attitude.

Table XVII: A Comparison Between Post-test Category Scores for Control (n = 51) and Experimental (n = 55) Groups [105]

CATEGORY	MEAN (Control/ Experimental)	STANDARD DEVIATION (Control/ Experimental)	T-VALUE
A Math Attitudes (1*,4*,6,15,21*,22*)	21.69/22.15	3.83/3.73	.62
B Understanding the Nature of Mathematics as an Abstract Art Form (2*,5*,8*,11,16*,19)	16.39/23.13	2.77/3.10	11.8

Table XVIII: A Comparison Between Post-test Items for Control (n = 51) and Experimental (n = 55) Groups [106]

DESIGNATED ITEM NUMBER ON THE EXPERIMENTAL GROUP'S POST-TEST	MEAN (Control/ Experimental)	STANDARD DEVIATION (Control/ Experimental)	T-VALUE (In Absolute Value)
1* I wish I hadn't taken General Ed. Math.	2.41/1.82	1.30/.84	2.77
2* Arithmetic computation is essentially what mathematics is all about.	3.45/1.76	1.12/1.02	8.10
4* I have a mental block about mathematics.	2.29/2.29	1.32/1.08	.01
5* Mathematics is a complete system where everything can be proved true or false.	3.29/1.96	1.30/1.15	5.55
6 I enjoy mathematics.	3.18/3.34	1.29/1.11	.72
8* Mathematics deals primarily with a description of situations and things in the real world.	2.82/2.24	1.14/1.21	2.53

15	I appreciate mathematics.		
	3.70/3.70	1.01/1.01	.00
16*	Mathematics involves learning certain procedures and applying them to solve problems, rather than artistic creativity.		
	4.04/2.38	1.00/1.23	7.66
19	I have a good idea of what mathematics is.		
	3.65/3.75	.91/.99	.53
21*	Mathematics makes me feel inadequate.		
	2.37/2.44	1.17/1.01	.30
22*	Suppose that you just got back a mathematics examination. Which grade are you likely to receive on this exam?		
	2.12./2.35	.77/.84	1.46

The general trend of the data indicates that both the experimental and control groups leave MAT 201 with positive attitudes toward "math." Table XVII indicates a slightly higher experimental mean for Category A, but the t-value is certainly not significant. However the data clearly illustrate that these positive attitudes are directed toward very different conceptions of mathematics for the two groups,illustrated by the (99 percent) significant t-value under Category B. For this reason we put the word "math" in parentheses.

An examination of Table XVIII provides specificity for these remarks. Item 2 illustrates how control groups left MAT 201 with the (mis)conception that mathematics is arithmetic computation, an impression that can easily be developed by presenting a survey of procedures (in statistics, probability, algebra, set theory, etc.) extracted from deductive structure with emphasis on "how to" while ignoring the nature of the subject itself. Ironically students are not opposed

to this numerical cookbook approach, for with a clearly presented procedure (reinforced via illustrative examples) they can then work out problems on their own and get the "right answer." Enormously popular at Miami-Dade Community College North is the MAT 120-MAT 121 sequence, courses in algebraic techniques illustrating how to work with signed numbers, factor, solve equations, compute with logarithms, and so on. Each little problem is immediately reinforced for the student with a correct answer. Unfortunately this approach may reduce math anxiety and may appeal to people because everything is so clear cut (it's either right or wrong), but it is as unrelated to the true philosophic nature of mathematics as doing finger exercises at the piano is related to playing music. The approach is appropriate in an Algebraic Techniques sequence, but MAT 201 is intended to be a math appreciation course. The bias of the MARP author, reinforced by our review of the literature, is that this appreciation should be directed toward the nature of the subject and not toward a reinforcement of math as arithmetic.

Items in Table XVIII indicate that the control group views math as arithmetic (item 2), is unaware of Godel's enormously important theorem illustrating the incompleteness of mathematics (item 5; this impression can be created by constantly solving examples and getting right or wrong answers), sees mathematics as limited to the external world (item 8), related to science rather than art or philosophy (item 11), and views math as a set of procedures for solving problems (item 16). However, this misimpression of the subject creates

attitudes as positive as those who have been exposed to the philosophic nature of twentieth century mathematics.

The units in Confluent Math that come closest to this right-wrong procedural approach are III (Symbolic Logic) and IV (Group Theory), although the "how to" is presented within a framework reinforcing the nature of the subject. Many students in the experimental section claimed to enjoy this more easily manageable part of the course than the first two units (Introduction to Mathematics and the (bizarre) Infinity) which raised more issues, questions, and perspectives than were actually answered. Let's face it--it's easier to get a grasp of how to construct a truth table than it is to use the ambivalent nature of transfinite numbers to construct, à la Ouspensky, a higher paradoxical Reality. It's also easier to teach (lecture) procedural content than it is to talk about philosophical ramifications growing from the soil of a most unusual subject.

Consequently although the experimental and control groups differ dramatically over how they view mathematics, most items in Table XVIII reinforce the fact that the groups both feel positively about their perspective at the end of the course. They both affirm that they have a good idea about what mathematics is (item 19; It would be interesting to bring the two groups together for a general discussion about mathematics and a sharing of differing perspectives!). They do not differ significantly in terms of mental blocks over mathematics (item 4), their enjoyment of the subject (item 6), or their appreciation of the subject (item 15). The only real difference in math attitudes is brought forth in item 1 where the experimental group significantly

(99 percent) felt better about having taken the course than the control group.

There are two items on which the control group did "better" than the experimental group. Items 21 and 22 reflect (on negatively worded questions) lower scores for the control sections, although neither t-value enables us to reject the null hypothesis at the 5 percent confidence level (item 22 is, however, close!). The explanation for this lies with the fact that the control group consisted of students with course grades of C or better whereas the experimental section had a distribution of grades including three Ds and two Fs. This might slightly affect the adequacy issue (item 21) and certainly would have an affect on a fantasized math examination score (item 22).

In short, data indicate the success of the Confluent Math course in the areas measured by the interdisciplinary course goals. The traditional MAT 201 approach appears to be equally successful in elevating math attitudes but ironically not in transmitting the true nature of the subject, a serious gap in a course that should move beyond procedures and ask the question: What is mathematics?

The area in which the two groups could not be compared is, of course, self-awareness, certainly the most innovative interdisciplinary aspect of Confluent Math (that is, integrating thematic motifs of the psychology of human potential into a mathematics course). Data indicate the significant impact that this area of the course had on students in the experimental group. We now turn our attention to an excerpted survey of the sorts of responses that were elicited in this component of the course.

CHAPTER 5

SELECTED RESPONSES TO THE CONFLUENT MATH AWARENESS ASSIGNMENTS[107]

In chapter 2 we pointed out that course participants in the experimental sections of MAT 201 were required to work on two self-awareness exercises throughout the duration of the course, including:

"Your Life as a Mathematical Structure"

and one of

"A Dream Journal"

"An Autobiographical Awareness"

"Three Gestalt Dialogues"

"An Integration of the Three Areas Listed Above"

All assignments carry the basic assumption that awareness of oneself as one is right now is more important than trying to change oneself or interpret one's behavior, both of which involve interfering with and distorting functioning. Consequently as we survey selected responses to these projects, our interest will not be in interpretation or analysis but rather in the issues that arose most frequently in the totality of responses and the insights gained by course participants (as they report them) in relationship to these issues.

The topdog underdog polarity discussed in chapter 1 found frequent application within the academic realm. The notion of self-improvement, tied into topdog demands of terrific grades, loads of time spent on

homework, perfectly written papers, and so on was balanced by a procrastinating underdog promising to do the work "later," get down to business "next term," spiting a nagging topdog that demanded perfection (generally equivalent to perfect grades) in relationship to school. This was the most frequent theme that arose in the assignments, although the style of topdog underdog differed dramatically from person to person.

One student strengthened her underdog response to a topdog filled with catastrophic fantasies. A common topdog manipulative device involves, "If you don't do what I say you should, then you'll---" with scenarios of academic (and future) failure inserted in the blank. But in this case, the technique failed.

TD: Well, here you are, asshole--at the end of the semester having to face your negligence. Hope you're proud of yourself. You could have kept working constantly and avoided this tension.

UD: Yes, I could have, but I didn't. Look, I'm sorry I disappointed you again, your highness, but I have a lot to learn. I'm beginning to think that what happened to me in the last few months was a more important lesson for my existence than maintaining my high scholastic average.

TD: Glad to hear that _____. Why don't you tell it to the Dean of Admissions at _____ next fall when your transcript turns to mush?? You are in school. You made a heavy commitment and you are not what you claim you are. Don't come crying on my shoulder when you flunk that math test...I'm sick and tired of your bullshit.

UD: I don't care what you say. I have a really good feeling within because I know I learned many things and got an opportunity to open up some doors for myself. I am not afraid of the old ominous word "math" anymore. Bob sparked something in my consciousness that I never thought I'd experience so get off my back. I will hand in what I can.

TD: Look, the world doesn't exist for you to do things when you feel like doing them. There are rules and laws and--

UD: I am doing the very best I am capable of at this particular time and I am willing to accept that I am not the greatest at everything I touch. But I can improve. Now go away and let me work...

Of course, a topdog with a differing style can insist upon perfection through impossible demands, forcing one to flee to insanity or the numbing effects of drugs simply to relieve the nagging and self-attack. This emerges in the following dialogue submitted by a student who had spent a considerable amount of time in mental institutions.

TD: Alright--, you want to fight with someone. Come fight with me.

UD: I don't want to fight. I just want to be left alone. Go away.

TD: Go to hell bitch. You won't get away from me this time. I'll kill you if you don't start acting right. You'll ruin everything if you're not careful. You will attend classes. I don't care if you're tired--I don't care if you want to talk to someone. You will do what I say when I say to do it.

UD: But I have been doing well. I know what I have to do and I almost always do it now. You confuse the hell out of me. I can't do everything. I can't make straight As. You make me feel that if I can't have As then I just want Fs. What's wrong with average? You keep me from feeling good and having fun.

TD: You just do your best and we both know you're capable of anything. You could do so much if you would try, if you only really wanted to.

UD: But I do want to. You're the one who stops me. I'll die if you don't leave me alone. You're smothering me. I don't want to be crazy again. I could learn so much more if you didn't scare me about not getting perfect grades. If you keep pushing I won't do anything. You make me sick by pushing too hard.

TD: You wouldn't do anything if I didn't make you. You'd fail without me. If I didn't tell you how to act you would get us put away. You won't get me put away anymore. For us to get where we want to be you have to do great. Everything has to be perfect and no help from anyone.

UD: If you don't leave me alone you're going to be sorry. I hate you and I hate me. I wish both of us were dead sometimes.

TD: Oh cute--real cute. You're a coward and you can't hate me more than I hate you. We've got too much to accomplish and you are going to do it whether you want to or not.

It is obvious that the two polarities of self are not really listening to one another. The underdog "You make me sick by pushing too hard" is virtually ignored, although the threat of insanity seems to have some effect, if only to keep the dialogue going. The topdog underdog encounter, paralleling an internalized parent child dialogue, is reflected in an episode from the same student's autobiographical awareness. At age seven we can recognize many of the styles of the preceding dialogue.

To Mother: I am trying honest. I just don't understand. I do study my spelling. I tried to pass the test yesterday.

Mother: You could have passed. You will study every night and then go to bed without supper or TV until you make an A on your spelling.

Me: I'm tired, Mama, please let me go to sleep. It's 1:00.(silently) I hate you. I wish you were dead.

Next week: Spelling Test

Mother: You failed? How could you?! You've been falling asleep in class too. You will go to bed as soon as you get home from school for the next week, you little bitch.

Me: I don't mind sleeping. I like it. I can pretend anything I want and no one yells at me if I'm asleep.

In a personal conference with this student, she was asked to read the last statement substituting the phrase "being crazy" for "sleeping." As she read, "I don't mind being crazy. I like it. I can pretend anything I want and no one [internalized mother; topdog] yells at me if I'm crazy," some positive payoffs of insanity began to emerge. One very real thing she got from insanity was the dissipation of self-nagging and self-attack.

Perls defines neurosis as the "failure to see the obvious."[108] In numerous cases the style--the sheer nastiness--of a demanding topdog

was inappropriate for bringing about the academic productivity that the topdog claimed it wanted. In the above example the topdog fails to see the obvious ways in which its style ultimately results in decreased productivity and academic impotence. Other student awareness assignments reflected this motif that can be handled by considering all voices of multitudinous self and asking:

What do I want?

Is my style appropriate or inappropriate for getting me what I want?

Many inappropriate styles emerged:

TD: You procrastinate in school because you're dumb. And you don't know what you're suppose to be doing. You have no organization.

UD: I do so! I just don't have time. I go to school full time and hold down a full time job--

TD: If you were so smart you'd do these assignments as soon as you got it so you'd have all your evening free. You're a loser!

UD: It just so happens that I have completed three and a half years of college and I'll be graduating in a few months. Call that a loser.

TD: Not bad for a late starter. We'll see if you really finish.

UD: I'll have you know you can't make me sad any longer by putting me down. I'll do my homework every evening to keep me from getting behind in spite of you--

---

TD: You'd probably get good grades if you ever got off your butt and studied. I'm ashamed of you--Unless you study and have a good education you'll never get anywhere in life.

UD: I can always push dope to make money.

TD: Finish your studies and make a profession.

UD: I can be a prostitute. It's the oldest profession in the world.

TD: How indecent. What would your parents say after hearing this statement from you?

UD: I don't give a damn what you or my parents say. I'll do whatever I want to do--

TD: You'll be sorry, you tramp.

UD: No you'll be sorry unless you shut up.

TD: You are not happy unless you get everything on a silver plater. You have to work for goals, get an education so you won't be a loser.

UD: I am tired of going to school. I start out all gung ho and by the end of the year I am looking at a bunch of Cs, Ds, and Fs. I feel like a dumb shit. Besides--who needs school. I have sponsors waiting for me.

TD: Just think, when you get your education for the rest of your life you can say I have a degree! I am an educated man--not a dropout--not a failure.

UD: Look--I am going to do what I enjoy. If you can't enjoy life it ain't worth living. Maybe I'll get drunk--sit home, watch TV for six or seven hours all by myself, and drink a fifth of J.D. black.

TD: You're turning into a problem drinker. I know you want good times. I know you'll get drunk--it usually does you good and you feel like a new man in the morning. But first pass all your classes this term because you only have a week left. I'm going to make you work your ass off--you can do it and will. Then we can decide about no graduation--no F.I.U.--no degree.

The above dialogue represents something not seen thus far--the beginning of compromise between two parts of self with differing needs and styles. Before integration of polarities becomes possible, each inner voice must state quite specifically what it wants. In addition the topdog and underdog must really listen to one another. None of this is possible without first establishing an awareness of the existence of conflict, later a potential source of energy. In this case, after a more detailed dialogue than quoted above, the student reported:

> "My script got me mad, but really helped me. By looking at what my topdog and underdog wanted, I brought the two to a compromise like I would with two people. They were both recognized and by giving them voices I

> was able to not let my underdog talk me out of doing what needs to be done. My underdog will compromise so I worked on homework for four hours and then watched TV and drank. What this did for me was to get me back on my feet again and fighting. When I have another conflict I am going to do a topdog underdog writing..."

Another student, working on Your Life as a Mathematical Structure, created one structure with the theorem "I am a procrastinator," and an alternate system with, "I have complete control of my responsibilities and my life." After developing the alternate system, he wrote:

> "I've always realized that I am a procrastinator but never really worked on it. This is the first time I put the issue on paper right in front of me and I found it very rewarding. Reading through my procrastination structure I experienced great frustration and anxiety--lots of tension in my neck. Reading through the second list opens up a potential course of action. Before this I never thought I had much of a choice to stop putting things off. For a few minutes as I created my new structure I lived it and I enjoyed the payoff much more than my present existence."

The academic theme again emerges in the following excerpted dialogue:

TD: Don't quit college now!

UD: I'm sick of it! I'm tired of working all the time!

TD: You're on the Dean's list with a 3.8 average. If I didn't hound you, you wouldn't fully do the work. All you have to do is finish Bob's class. Come on, shake a leg and do the work.

UD: But there's so much stuff to do with very little time to do it. I have so many things on my mind.

TD: We'll discuss that later. If you really want a scholarship to _____ you have to get that high grade average.

UD: I've wanted to go there for over five years. I guess I'll stick with the work. If I work will you help me stick with it until it's all done and not let me quit?

TD: Sure thing! I'll bug you till you get it done. I'm surprised you want to quit. Believe me, you will be glad you listened to me.

UD: I believe you.

This is an excellent example of a student recognizing how she needs her topdog--a topdog whose style is not filled with the self-attack of some of the earlier excerpts. The student reported, "I like my topdog and she likes me. She's like my mother, always wanting me to strive for the highest degree possible, keeping me on the straight and narrow."

Although many topdog demands centered around academic achievement, other areas emerged in the awareness assignments. A number of students dealt with "shoulds" in relationship to their bodies:

TD: You should go on a diet. I'm sick and tired of looking at roll!

TD: You should get those ugly pounds off. My G-d you've been fat for four years now. You look so matronly and so packed in.

UD: Don't you think I can see myself. I know how heavy I am--but I can't seem to lose it. I try.

TD: You've got to like yourself a little more kiddo. "Cuz that's what it's all about. You've got to straighten yourself out and set up your own diet plan to fit your needs.

TD: Boy are you fat! When are you going to lose some weight there Blimpo?

UD: I'm not fat, I'm only 10 pounds overweight.

TD: Only 10 pounds you say? That's 10 pounds of hard lard! I want you to diet, starting today, and don't you dare break it!

UD: You make me so upset, I need this lemon chiffon cake to calm down my stomach--

TD: Listen here, you oversized obese thing! Don't eat that cake--it's crawling full of maggots. If you eat the maggots, they'll crawl all over your insides and make you even more stout than you are, Blimpo!

TD: You should do your exercises. You're not getting any younger. When summer comes your body will be disgusting in a bikini.

In terms of frequency, after self demands in academic and body

areas, the awareness assignments dealt with the general area of sexism. Sexism, manifested primarily through male supremacy and heterosexual chauvinism, is a "conditioned belief, put into practice in global ways, that the sex of a human being and/or the sexual orientation of a human being either gives or denies one certain privileges, powers and roles."[109] One of the traditional roles for women involves finding a husband for security-breadwinner-protection, placing pressures on men and women. Many female students dealt with the career versus security-as-housewife issue:

TD: You must finish school and get a good job in order to survive in this world.

UD: No--I'd rather get married now. Anyways, by the time I get a degree, I won't be able to find a job.

TD: That's a cop out! You just don't want to face the responsibility of school and a career. You just want to be dependent upon someone, so you don't have to work.

UD: Well, I love _____ and I want to get married. That's all there is to it.

TD: Go ahead--get married, have twenty kids for all I care but you're too intelligent for homelife. What will you be working for? His happiness or yours?

UD: But I want a home and a family so much. I'm sure I would be happy.

TD: Maybe. What happens if your husband dies or you get a divorce? Your crutch will be gone. How will you react? How will you survive?

UD: I could find some kind of job.

TD: Sure you would--at a Burgershit place. You think you're going to be happy ten years from now with no education.

UD: Well, I guess not.

TD: I'll tell you what, we'll meet halfway. You finish four years of college. Find a good job. See if you're happy. If at the end of it all, you still want to get married, go ahead. At least you'll have an education to fall back on. How's that sound?

UD: I guess we could do it that way. I've waited this long, so a few more years won't hurt.

Voice 1: What am I going to do with my future?

Voice 2: Take risks, kid, you're good with music, you've done studio work--

Voice 1: Yead, but what about--? I just don't want to gamble ya know. How do I know that I can sing for a career? I don't want to throw away a good man and all the plans we've made.

Voice 2: If he was such a good man, he wouldn't keep you from growing. You got a dream--get it! Nothing's impossible. Life is exciting--not a stay at home, sew, cook, and clean.

Voice 1: Chasing dreams. I want something more secure. I don't know if I can cope with career pressure.

Voice 2: Listen get your shit together, lady. You're giving your power away.

Voice 1: I don't know what I want or what's best. I just don't know. I feel so damn lost.

(Dream excerpt and dialogue)

"...I am alone until I get to the bottom of the stairway where there are many people, some in military uniforms. Although nobody has approached me, I know the school has been taken over by Russian soldiers...I take out coins and this American officer behind me says, 'Give them Russian money.' The American officer is tall, handsome, polite and well spoken. I admire him. I believe him and I take out only the Russian coins I have in my wallet..."

Officer: I am in charge of the people who have been taken over. I know what is best for them. I know more about what is going on at this college than Susan [disguised first name of the student who had this dream]. Poor Susan is confused, she needs help. She is too soft.

Susan: I like this officer. He really knows what he's doing. I feel inferior to him. I want his approval. I need his approval.

Officer: How can you ever be as good as me? I am perfect. I am here to right the wrongs of the world, to make peace. All you are interested in is your own selfish needs.

Susan: You make me feel so ashamed. I know it is wrong to consider my needs first. Sometimes I forget. Sometimes it feels good to do things for me first, though.

Officer: That is wrong. There are other people to consider. Think of _____. You should be home taking care of his needs. You don't have time to do all the things you used to do for him before you started going to school. You don't cook for him and mend his

clothes, and he does so many things for you. He gives you whatever money you need to buy what you want, and he loves you and is kind to you. You are very selfish to him. And what about the kids?

Susan: _____ doesn't seem to mind me going to school. He never complains. The girls seem happy, even proud, of me going to college.

Officer: Be like me and sacrifice your personal desires. Being a good wife and mother means sacrifice.

TD: I think it would be wise for you to stop seeing Rick. Go, move, but leave him. You don't love him back the same way he loves you.

UD: So! I enjoy his company greatly. He is one of the managers at _____. He can grant my every little whim. He's got money sticking out of his ears and he loves spending it on me and making me happy.

TD: He just bribes you with material things to get your attention, and you being naive fall for it.

UD: I love the security. I'm also afraid of what would happen if I backed out...

The component of sexism involving the male as security object, with the lyrics of "A Good Man Is Hard To Find" providing background music to the excerpted exercises thus far, also entered an assignment turned in by a male. In processing his dialogue, he wrote:

> "It seems very evident to me that the financial status of a handsome male specimen is the key to a so called successful good time date scene. If the money is there she'll have a good time; if it's not well I don't stand up in the technique category. Granted I am a lover of the artwork of women, all kinds, but when it comes to friendly, simple, individual appreciation and conversation, I have found very few who dig it."

The use of the word "artwork" is of interest, for it establishes the duality involving male as security object and female as sex object. In The Liberated Man, Warren Farrell argues that the male gender role learning process places things (stereos, cars, cameras) into a focal position, setting the stage for many men to objectify women by relating,

sometimes contemptuously, to body parts (breasts, vaginas) more than to total human beings.[110] Objectification emerges linguistically with phrases like, "I'm going out to get a pice of ass," a cruising game in which one hopes to win by scoring. Farrell asserts that to grow up a boy is to be able to say something condescending about women (they're sugar and spce and everything nice), or something contemptuous about women (the four fs--find em, feel em, fuck em, forget em), or something condescending to women (don't worry your pretty little head).[111] Kinsey estimated that no less than two-thirds of heterosexual men don't like women,[112] reminiscent of Ben Gazzara's line to his buddies in the film Husbands: "Except for sex and my wife's very good as sex, I like you guys better."[113]

The objectification theme appeared in a number of female awareness projects, as in the case of the student who wrote, "Most men are exploitive, aggressive and treat women as sexual objects! My own experiences have affected my feelings and attitudes toward men in a collective sense. That doesn't mean that I haven't found exceptions." Of course, objectification is just one component of male contempt for women. Like aggression and violence, this contempt is taught, learned, and acted upon. It is found everywhere: in an orthodox Jewish prayer of rejoice ("Thank God I'm not a woman!"[114]), on the bathroom wall at the NYU School of Law ("A growing body of law: The Mona Goldman-Elaine Haberfield controversy--WHO HAS BIGGER TITS?"[115]), in lyrics from Broadway musicals ("Oh gee a girl sure plucked a living in being born so weak and feminine. She's no use, she's no excuse for living that I can see"[116]), and in a female student's awareness project dealing with

her prejudices ("All women are bad drivers. They tend to be very nervous and so this causes them to panic which leads to accidents. Men have more control.")

The dimension of contempt runs the continuum from "all women are bad drivers" to women being battered recipients of male violence. Five awareness projects turned in by women dealt with this latter area. Much of the unfinished business--the unexpressed resentments, demands, and anger--of being a physically abused woman emerged to the foreground in the awareness projects. This is evidenced by the following excerpts:

(Autobiographical awareness) "...he's drinking again. Oh God he's crazy. I better not say a word. I hate you, but I won't allow myself to feel it. No--don't hit me--not in my face--help! help!-- _____, don't punch a hole in the wall. I want to get out! I'm afraid! I feel sick and I hurt so much. I resent you for hitting me and screaming at me. I resent you for wanting to make me your slave. I resent you for so much pain..."

After working on this portion of the assignment, the student had a dream:

"I'm standing in a room. There's not much around--a table, some cabinets and a man. I don't recognize him, but he knows me. He is holding a piece of vinyl. It's rolled up and hard. He says, 'Hey--look,' as he rolls and unrolls the hard piece of vinyl, 'I've been waiting two years for this. I've been suffering so long.'"

Based on the Gestalt notion that each part of the dream is a projected portion of self, the student played the piece of vinyl. By giving each part of the dream a voice, dialoguing among parts, and putting the dream together, one could reown projected fragmented parts, thereby rediscovering hidden potential and strength.

"I am the vinyl. I am rolled up and hard. I am white with small gold speckles. I'm bendable, but it takes a lot of strength to straighten me out. In fact, I'm tough and hard so it won't be an easy task. As a

matter of fact, I fight him. I won't let him overcome me."

As the vinyl, this student also made statements applicable to her existence. The awareness of vinyl portion of self presented strength that she felt would help her to get out of the situation and put the nightmare behind her.

"I'm learning to be a fighter. I've done my best to become tough and hard hearted because I hated being hurt. I am the vinyl. I know that I won't be pulled down by _____. He can't overcome me..."

The notion of discovering a strong part of self to deal with the humiliation and pain of being beaten (and take the necessary action to get out of the situation) also arose in the following excerpt. After expressing resentments and demands toward her husband within the framework of the autobiographical awareness, a student reported:

"I experienced a great relief to get all these things out. At first it was hard to write then they just started flowing out. It is really great to see these things down on paper and out of my head... it shows me all the stupid bullshit I put up with because I didn't use my strength to demand these things [the beatings and violence] to stop..I find myself reading over this list again and again...I have fallen short of myself by letting things go so screwed up and taking it. Thanks a lot for having this assignment because this was fantastic. What a relief of the brain. When I was with him last night I had a completely different attitude about myself and what I want and can do..."

Earlier we quoted a topdog underdog dialogue in which the topdog wanted the person to "stop seeing Rick" and the underdog claimed to "love the security" of the relationship. The underdog stated, "I'm also afraid of what would happen if I backed out." Being both the seeker of security and the potential victim of violence, the following dialogue (continued from the earlier portion) resolves itself in favor of self-preservation.

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"I am the vinyl. I am rolled up and hard. I am white with small gold speckles. I'm bendable, but it takes a lot of strength to straighten me out. In fact, I'm tough and hard so it won't be an easy task. As a

"I just got home and he's in a rage. I don't know why--he's been drinking and when he got home I wasn't there. I feel sick--I got my wisdom teeth out last night and have six stitches in my mouth. He's coming toward me--help--oh God he's ripping my mouth apart. The pain is excrutiating and I think he really might kill me."

As we mentioned, the function of the awareness assignments for all five women was to give them the very real possibility of doing something about existing in a field that was lethal to health and self-growth. The awareness of inner strength translated into the very real decision to get out these destructive relationships. All women were referred to an agency that deals with physically abused women. Two of the students attended these group sessions where they had an opportunity to share their experiences with other people in similar circumstances. At the conclusion of the Fall term, three persons had left their partner, one was about to "cover her tracks," and one felt that her new inner strength would enable her to resolve things with her mate. In a very real sense, the awareness projects presented concrete alternatives to the musical ("My Man") question, "He isn't true. He beats me too. What can I do?"[117]

The traditional roles that made up our definition of sexism and the desire to transcend some of these roles formed another frequent theme of the awareness assignments. In an earlier excerpt, a mother dealt with the expectation of sacrificing for her family. In the following dialogue between a mother and her daughter who was killed in an automobile accident, the expected role involves suffering. In a very risky dialogue, the mother (who had put on one hundred pounds since her daughter's death) brought back her daughter and wrote:

Mother (to herself): You should continue to suffer and look like a mother who is suffering.

Daughter: Mom, you look terrible. What did you do?

Mother: I am showing you that I am suffering.

Daughter: Mom--(she laughts)

Mother: If I look good, would you think that I'm having a good time if you're away?

Daughter: I always cared how you looked.

Mother: Yes, we used to go to the beauty parlor together. I miss that. I miss you. But if I look good and am happy it looks like I don't care about you any more. I cannot stop hurting. If I only could put my arms around you again. I cannot accept what has happened. I won't say goodbye to you. A mother must always keep a door open for her children. I cry and I look real bad for you so that you know I am suffering and miss you.

Daughter: I don't want you to hurt--

Mother: I cannot stop. I won't say goodbye to you.

Ironically after writing this dialogue the student made the first attempt (in the three years since her daughter's death) to do something about her weight.

The expected role of a female remaining "true" to her man, tied in with the double standard notion, generated the following dialogue:

Voice 1: Well why don't you just date Gil and Tony?

Voice 2: Because I'd be cheating on Tony.

Voice 1: Tony is cheating on you, stupid! There's nothing wrong with the two of you seeing other people. It's healthy.

Voice 2: It may be alright for some people but not for me.

Voice 1: You are an insane ninny.

The theme of heterosexual chauvinism was quoted in chapter 1 in relationship to exploring present behavior and alternatives within the framework of deductive structure. One male athlete constructed the following systems (definitions are omitted):

Theorem: I am resistant to expand my sexuality into the area of homosexuality.

Axioms:
1. Men should only have sex with women.
2. Only heterosexuals have self confidence.
3. Men who have sex with men are discovered by their peers and rejected.
4. Men should dress up and look good for women rather than for other men.
5. One should try everything once.
6. I feel very uneasy when a male makes advances toward me.

Theorem: I am extremely into homosexuality and will perform to my best for my mate or mates.

Axioms:
1. A man is in the best position to satisfy other men.
2. Close male friendship is more fulfilling than a man-woman relationship.
3. Females are nothing but toys for men to play with.
4. One should fulfill oneself in all ways.
5. The male penis is fascinating.

It is interesting to note the degree of objectification that enters both the heterosexual and homosexual arena in this student's response. Females are seen as toys (things), yet homosexuality is reduced to centering around the penis object--fascination with a thing. Cultural linguistic labels concentrate entirely on to whom one relates (heterosexual; homosexual) and ignore how one relates, so that within either arena one can be isolated from real contact by refusing to accept sexuality as anything other than a genital urge. In this case the student who had never participated in homosexual sex, presented his definitions in a "I'd like to lay you" rather than a "I'd like to lay by you" context. His definition for axiom 5 ("male penis is fascinating') was:

"I just love the shape of a man's penis. I cannot resist looking at the crotch of a man and envision what his penis looks like. The shape and softness of a man's penis is like no other feeling in the world. I wish I could go to bed at night with three or four penises rubbing against my body."

This sort of response, objectified or not, obviously was a huge risk for a person labeled by his peers as a "jock" to take. Using the alternate structure to express previously repressed feelings, the assignment had tremendous therapeutic value. The student reported:

> "I learned a lot more about myself than I ever thought I would... the second part was unbelievable. It was really a strange experience for me. Bob I want you to know how hard this was but I know I did my best...this assignment was just what I needed right now. I couldn't wait to get started. The most amazing part was getting an erection writing the second list. I had something very definite I wanted to work on and it all developed from there."

For many men, a large segment of their feelings about other men are unknown or distorted because they are afraid they might have something to do with homosexuality. The spectre of a label, argued by many to be artificial and irrelevant since it has nothing to do with how one relates, seems to be "a dragon at the gateway to self-awareness, understanding, and acceptance of male-male needs."[118] This idea appears in the following topdog underdog dialogue turned in again by a male athlete who in external reality had never experienced sex within a non-heterosexual context.

TD: You should really go out and find yourself longlasting friendship with males.

UD: Being too close with other men makes me uncomfortable. I'd rather have girlfriends.

TD: We both know why you're reluctant to be close with other men. You're afraid you would jeopardize your lifestyle. You ought to be involved with other people than just your girlfriend.

UD: I don't even know how to start getting close to other men without them thinking I'm queer.

TD: You said it. If you were a little bit more confident about yourself when it comes to sex and lost some weight in your stomach you wouldn't be hung up on the queer thing.

UD: I'm very leery of advances by another person. You know how I get turned off when a guy tries to make bold advances--

TD: We're talking about friendship. The closeness of some of the guys on the [name of sport] team is unbelievable. Together they can touch the stars and you can see that. It's far greater than you have with _____ and her children. You know you want that.

UD: I do and I don't. And I don't know how to start. I'm not that confident. After all, it's not like coming on to a chick--

Thus far we have examined the themes of topdog academic demands and the web of issues under the umbrella label called "sexism." The third most frequently appearing issue in the student awareness assignments centered around loneliness, shyness, and insecurity. Perfectionistic demands, plus a degree of detachment through humor, appear in the following example illustrating this issue.

Theorem: I am constantly making an ass out of myself in social situations.

Axioms:
1. I feel obligated to be funny.
2. I am dumpy looking.
3. I feel inferior.

Definitions:

1. Funny: at a 'poetry-in-the-schools' meeting, one who tells about her sixth grade teacher who would wretch and pretend like she was going to vomit when the class misbehaved.
2. Dumpy: one who has a) short muscular legs, b) large overpendulous breasts, c) a large ass, d) ten to fifteen extra pounds.
3. Inferior: one who a) has no writing published in a group of published writers, b) has not been to Europe in a group of people who have each spent at least six months there, c) has not completed the A.A. requirements at MDCC with a group of people who are completing their masters, d) likes Richard Brautigan in a group of Hemmingway lovers.

New Theorem: I am always confortable and sure of myself in social situations.

New Axioms:
1. I am knowledgeable in many fields.
2. I know what to talk about with anyone.
3. I am attractive.
4. I am clever.

New Definitions:

1. Knowledgeable in many fields: one who can talk about anything from vasectomies to Simone Beauvoir to strip mining and know the facts regarding the subject.
2. What to talk about with anyone: one who a) talks about Sesame street with kids, b) talks to students about school or rock concerts, c) talks to old people about Social Security or the good old days.
3. Attractive: one who has a) a long, long body and long legs, b) brown skin, c) small breasts, d) slender limbs, e) large eyes, f) large, straight, white teeth.
4. Clever: one who can be a) cruel and catty, and at the same time have everyone love her, b) humorous and make off-the-cuff jokes that are relevant and unoffensive.

A very similar structure was turned in by a male course participant.

Theorem: I am uncomfortably comfortable around people.

Axioms:
1. My stomach is flabby.
2. I sometimes say foolish things.
3. I sometimes don't know what to say.
4. I don't want to offend people.
5. I enjoy the warmth of people.

Definitions:

1. Flab: My stomach is ugly because it represents a lack of concern. I can imagine people saying, "I can't imagine how someone could let themselves go like that."

[This student was asked to write a dialogue between these "people" who said "I can't imagine someone letting themselves go like that" and himself where he responded to the accusations. Eventually the student reached the point of replying, "Get off my back and leave me alone," strengthening his reply to self-nagging which had little to do with the reality of his stomach. The so called "flab" had been lost ten years prior to writing this structure and in reality the student was actually thin.]

2. What to say: Sometimes I get so wrapped up with what to say that I end up with nothing to say. The person is talking and I am thinking what to say. They stop and I realize that I really haven't heard what they said.

[Warren Farrell calls this process self-listening "in which the man will listen to the first sentence or two that a person makes, assume he knows what is to follow, and start forming his own story related to his own accomplishments"[119] and his own verbally glib contribution in order to transfer the focus to him. Farrell, using a watch with a second hand to time the amount that men speak as opposed to the women, discovered that men will speak two to ten times as frequently as the women, "particularly if the conversation is considered serious and is not personal."[120] The problem of rehearsal in one's head, pointed out by the above student and reiterated by Fritz Perls, is that if you're busy with your biocomputer-rehearsing, analyzing, figuring out--it's impossible to focus on what's going on around you. You choose neither to see or hear.]

Still dealing with the theme of shyness and insecurity, a student again used the deductive framework to explore self.

Theorem: I am an insecure person.

Axioms:
1. I have very little confidence in myself.
2. I feel a lack of motivation.
3. Drugs provide self confidence and peace of mind.

Definitions:
1. Insecure person: one who does not believe in himself.
2. Confidence in myself: one who lacks the feeling of being comfortable around others.
3. Lack of motivation: having no interest in something which I have to work for.
4. Drugs for self confidence: drugs help me forget my insecurities.

After exploring an alternate framework around "I am a very secure person," the student processed his structure with a scenario typical of numerous students the MARP author has counseled during his six

years at Miami-Dade.

"After completing this assignment I have come to a realization that it is easier to be honest with myself than I thought. The first list is composed of a theorem of insecurity and axioms describing it. This theorem and the axioms from the first list come from years and years of certain experiences through my life, which has been on the most part a bummer. Although I received a lot of affection and money from my parents I was a very unhappy child and when Junior High School came around, started getting high on an everyday basis. I have never done well in school as a matter of fact, and I don't know how I got through it. I never excelled in anything. I've never had many friends and do not trust anyone. Girls have only been one night stands. I don't think I would be particularly happy if I was the second list. [I am secure; confident; productive; vibrant; don't use drugs to free inhibitions]. I don't even like college. The only reason I'm here is for money. I can use it to live and help me enjoy life with the only things I know how to enjoy. That is material goods."

The following structure of shyness is an existential reflection of a dream fragment.

Theorem: I am very shy.

Axioms: I am so stupid.
I'm not worth talking to.
Life hasn't really treated me well.

In the first two axioms it is <u>not</u> life but the student herself who is not treating her well. Her structure, a vicious self-attack providing no self-nurture, is paralleled in a dream where later she gave one part of the dream a voice. The voice of the dream part is the voice of the attacker who spew forth the first two axioms listed above.

"I am slimy and slippery. I am all full of cracks and crevices. I am here to kill and to destroy. It gives me pleasure to see you fall. I exist to make things difficult and dangerous,"

Another student, creating "I am very shy" and an alternate extroverted system, began to gain an awareness of the payoffs of her behavior. She wrote:

"Being shy does have some advantages. I have developed very good listening skills. I remember the things I hear most of the time. The

things I've learned through good listening have helped me decide which values I want to live with. I also devote a lot of time thinking about things before I do them. I've learned to think about my problems and decide what I want in the future. There haven't been many times that I have regretted my decisions. Being shy has helped me form my value system, but being shy also hinders me from expressing those values."

The fear of being alone because of the death or disappearance of those close to her form the existential fragment of the subsequent recurring dream and dialogue:

"I m on stage in the old gym. There must be about one thousand or more people seated in the audience. I'm delivering the graduation address. I can't hear anything I'm saying. Slowly the faces of the people are turning unfamiliar and vanishing. Bells and chimes are ringing louder and louder. As the names of the graduates are called they are walking up toward the stage and disappearing. I keep looking at the stack of diplomas and I'm hoping there's one left for me. I keep waiting for my name to be called. And I can't hear it. Everyone has gone except me. All I hear is the sound of the fans blowing. All of a sudden there's nothing or nobody except me. I'm frightened now and I always wake up at this point."

Voice: I am disappearing. I exist to frighten you.

Me: Why do you want to frighten me?

Voice: Because I can make you do what I want you to.

Me: What do you want of me?

Voice: To see you suffer and become unhappy.

Me: I don't like to be unhappy.

Voice: I know...you do your worst when you're sad. I can make you sad whenever I want to.

Me: How?

Voice: By taking someone out of your life that you really care about.

Me: Why?

Voice: To have you under my control. You created me and now you can't control me. I can take whomever I want and scare you. I used to listen to you say that tired old phrase "Oh how I hate the thought of losing my father, my mother, my brother, or the man I love." Take your choice, who would you like to lose first?

Me: Please don't take anyone from me. I don't want to be without any of these special people in my life.

Voice: I'm sorry it must be done.

Me: I won't let you.

Voice: You can't stop me.

Me: I'll do anything I can to destroy you.

Voice: You can't destroy me. I'm a part of you. Destroy me and you destroy yourself.

Me: Now I'm not even afraid of you. I'm so angry right now that if I could see and touch you I would without a doubt destroy you bit by bit. I could really take pleasure in doing it!

In confronting her self-frightener, the "me" of the dialogue continues to grow more powerful, discovering inner resources to deal with the powerful threats of the voice. After concluding the dialogue, the student affirmed:

"The voice was so strong that it created anger within me. I've always been so afraid to even deal with everyone dying and leaving me alone, but with the dream therapy I got angry and now I feel I'll be able to at least talk about it more. Playing the voice and me separately was very helpful. When I read through my dialogue the voice seems so crazy that I just want it to get lost."

Again, the theme of loneliness expressed in a life-theorem statement of "I don't have any close relationships with people right now" brought another student to an awareness of the payoff for this created structure.

"The payoff is being safe. Negativism and despair actually can become 'comfortable' after a while, at least in the sense of providing emotional security. Also, opening myself up gives people the chance to reject as well as accept."

Expected roles, even more defined for Spanish women than American women, contributed to the loneliness structure of a Cuban student.

Theorem: I have no friends.

Axioms:
1. There's no true friendship.
2. Friends criticize one another.
3. Women should devote all their spare time to their husbands and family.

4. Good friendly relationships could be held only with close relatives.
5. Women should not talk to strangers.
6. Married women should not go out with male friends (not even in a group) unless their husband is present.
7. Male friends sooner or later want to try to have some sexual relationship.
8. Female friends will sooner or later want to flirt with my husband.
9. Women are jealous by nature.

The same student took her ninth axiom and used it as a pivoting point to discuss her own jealousies.

"If he [husband] has an affair with another woman that would mean that he doesn't love me so I would divorce him. I'm afraid of being a divorced woman because I'll have to start meeting friends cause I have none and I'm not very good at that because of my axioms... I'm afraid of being lonely."

Once again, the chain of logic sets up the husband as security object in the sense of being a buffer, an anti-loneliness antidote for a continued sheltered protected existence.

Many of the other awareness assignments did not fall into the academic demand, sexism, loneliness trichotomy, but are worth mentioning. The notion of guilt as unexpressed resentment, with demands underlying this resentment, arose briefly in a topdog underdog dialogue written by a divorced man.

TD: Why don't you spend more time with your children? Why don't you let them stay at your house more? Why don't you buy them more things that they need? Why don't you take them to different events?

UD: I don't know--sometimes I feel guilty because I don't and that's why I spoil them instead of disciplining them.

In a private counseling session, the student was asked to address his children in fantasy and begin expressing his resentments toward them. One of his major resentments was, "I resent you taking up the time I need to work through my own problems." Once the resentments began to flow

("I resent having to drive long distances to take you places. Driving flips me out. I resent having to clear my house of people when you come over. I resent buying you things because I'm broke." etc.), the expression of resentments--getting them out--resulted in the dissipation of guilt.

One student who had been taking amphetamines to function at a normal energy level explored his present life-theorem "I don't have any energy" and the fantasy alternative "I am always hyper." To his amazement, as he created his new structure, developing exciting supportive axioms to elicit the hyper behavior, he found that he experienced being hyper and energetic. Processing the experience a few weeks later, he wrote:

"Lately I've been sleeping six hours a day instead of twelve. When I wrote 'reading is exciting' as an axiom in my hyper-structure, I was sort of bullshiting but lately I've been reading a lot and not getting tired. I thought that my tiredness was physical but when I got energy just writing a list I think a lot of it is psychological... I haven't taken medicine for a week and I'm still going strong. You wouldn't believe how my attitudes have changed."

A former professional dancer in the MAT 201 experimental section used the awareness exploration to dialogue with a part of her body that she felt dissatisfied with.

Doris: Well you've done it again.

Breast: I've done it.

Doris: Yes, how do you expect me to be noticed? I've beautiful hips (39½"), a great waist (27")--every time I see a guy, one look at my top (not even a full 33 inches) and that's it--gone.

Breast: So I'm the blame. Damn it, I'm tired of always being your downfall. Can I help it if I'm only a mouthful?

Doris: Grow--why can't you just grow?

Breast: How the hell do you expect me to do that? After two kids I didn't grow. Remember, I'm not the one who chickened out on the silicone.

Doris: Silicone! I don't want imitation breasts. I want me real, soft and sensitive like now..only fuller.

Breast: Fuller?! Weren't you married? He must've liked small ones--he stayed around for five years. And yes, the cute Puerto Rican adores my nipples.

Doris: That's because he's too young to know anything. Besides that's robbing the cradle.

Breast: Doesn't my sensitivity stand out? I suppose you'd rather have 38's or 40's. You'd need crutches just to hold me up.

We could obviously continue for hundreds of pages quoting the totality of student awareness assignments turned in as part of the MARP research design. The selected excerpts presented do, however, point out the value that the awareness portion of the course held for many of the students. In the first place students were given an opportunity to deal with personal issues, conflicts, and feelings that normally they do not have the chance to express. Simply getting it out and putting it on paper served a cathartic therapeutic function for many course participants. Many students found it helpful to consider ambivalent components of self in a separate manner, gaining insight into different parts of their personalities with very differing needs and styles. The intent of the assignments was to give students an awareness of the existence of these polarities. What the student did with this awareness or these insights was a matter of personal choice. The MARP author intervened only in the case of women who were being physically abused by their partners, referring these people to a crisis intervention center. Numerous students also got together with the MARP author to discuss or do further work on the issues raised

in their assignments.

Retrospectively, course participants took enormous risks dealing with personal issues usually considered taboo within an academic framework that nearly exclusively emphasizes cognitive functioning or very superficial areas within the affective domain. But here we have seen people being upfront about their own self-loathing, their self-demands and threats of insanity, their desire to turn to prostitution rather than the academic route, their alcohol problems, their weight problems, the security versus career issue, their physical abuse and humiliation, dialoguing with a dead child in an attempt to establish some sort of closure on the past, homosexuality and explicit genital fantasies, feelings of "dumpy" inferiority, insecurity, shyness, fear (or an effective self-torturer), guilt, and dissatisfaction with breast size. Even within these selected excerpts the reader might wonder why students were willing to take the risk to reveal these things on paper, going far beyond the affective approach of merely asking people how they feel as they learn (although processing reactions to learning about pure symbolic abstraction is a part of the Confluent Math product).

The answer to this lies very much in the attitude taken in class by the MARP author. Initially students had to be told about the components of the Gestalt awareness model, the topdog underdog polarity, Gestalt dreamwork, themes similar to mathematical structure and the awareness model, how to proceed with an autobiographical awareness, paralleling the assignment with the direct experience theme of The Natural Mind. Students were shown films of Dr. Frederick Perls using

Gestalt techniques with clients. But the impetus for students to open themselves up came from the MARP author taking huge risks in class and sharing his own conflicts, issues, and experiences in relationship to the awareness techniques. The more that the instructor shared about his own existence, even if for some students that meant labeling him as "weird," "strange," and so on, the more personal and filled with risks the student responses became. It seems obvious that the example of being open and honest about one's existence would have to come from a course instructor in order to expect students to do the same. In this sense the course instructor is an independent variable of the research that really cannot be overlooked. Also of great help in terms of students opening up was not making any sort of value judgments as to the direction or polarities they developed.

One aside in relationship to instructor risk leading to student risk is worth noting. One of the assignments--not part of the major awareness assignments--was based on the fallacy called "argument from a weak analogy." In the course reading entitled "Fallacies in Everyday Life" (Unit III - Symbolic Logic), the text example was:

> All people from Nebraska like apple pie.
> Jones is from Nebraska.
> Conclusion: Jones likes apple pie.

The weak analogy between Nebraskans and apple pie lovers is in a real sense a prejudice. Consequently students were asked to examine their own weak analogies, listing them and discussing what effects these prejudices had on their relationships with other people. Course participants were also asked where prejudices came from, how they felt about them, and whether they would be willing to give any of them up.

The responses illustrated, partly to the dismay of the MARP author, the degree to which students were willing to be open and honest. Despite the fact that all students were aware that the instructor was Jewish, the assignments again and again displayed open anti-Semitism. In a sense it was healthy that students felt they could open up and say anything to their instructor, although the MARP author, like most Jews who are directly linked to the memory of the Holocaust, was extremely distressed at the degree of anti-Jewish sentiment expressed by course participants. The number of anti-Semitic comments was far greater than that expressed toward any other group. These included:

All Jews are in business and rich.
All Jews are prejudiced against Christians.
All Jews have a persecution complex.
All Jews are paranoid and instill their paranoia on their young through lies about millions of Jews being killed by Hitler.
All Jews (at least 80%) are cheap.
All Jews think they are discriminated again.
Most Jews control television and banks.
All Jewish women are spoiled princesses.
All Jews have ugly noses.
All Zionists should be shot.

Finally, despite the open appearance of these excerpted assignments, along with the many assignments not quoted in this chapter, one must ask about how honest students have been and to what degree they wrote what they thought the course instructor expected. It is obviously not possible to definitively settle this issue, although the MARP author reiterated numerous times that he had no expectations as to issues considered or the depth that students wished to pursue. The only area in which the instructor became somewhat skeptical involved those assignments which resulted in instant magical "cures." The

first step to change involves awareness, so that these assignments were aimed at clarifying issues, giving students a chance to discover dynamics of their needs, their style for getting what they need, and their feelings as they relived memories, constructed structures, or created dialogues. The instructor was skeptical about the instant changes that some students reported--as in the case of the student who gained enormous energy and stopped taking amphetamines after writing a structure dealing with the life-theorem "I am hyper." There is, of course, no way to determine if this dramatic change did or did not take place, so the reader is asked to decide for tirself the degree of authenticity found in the assignments presented throughout this chapter.

Finally, in examining these selected responses, the reader is referred back to chapter 4--Table VIII and the verbatim comments following the table in which students actually evaluated the success or failure of the course goal ["The participant will use mathematical and philosophic ideas, along with Gestalt awareness techniques, to gain increased self-awareness"] which gave rise to these projects.

CHAPTER 6

CONFLUENT MATH: FUTURE POSSIBILITIES

The design and evaluation of Confluent Math was intended to have continued impact well beyond the author's graduation date from Nova University. The innovative interdisciplinary nature of the MARP product gives it potential use outside MAT 201 (General Education Mathematics). In this chapter we shall consider future possibilities for the product at Miami-Dade Community College North, directions that will continue to involve the author in curriculum development through the integration of affective components of the Behavioral Sciences into traditionally cognitive areas.

Before discussing specific possibilities for the Fall term of the 1977-78 academic year, it would be of interest to briefly examine to what extent the Confluent Math philosophy is compatible with the direction of general education at Miami-Dade Community College and the particular competencies in General Education Mathematics deemed significant by the Miami-Dade North Department of Mathematics. As we shall see, although the work of the MARP author was carried out independently, his general outlook nearly paralleled the work of the General Education Study Committee, a group represented by all campuses of the College.

Many of the comments made by the General Education Study Committee sound as if they were extracted from the present document. For example, "The general education curriculum should have as one of its principal

aims the integration of the students' knowledge, skills, and learning experiences...General education involves not only the highest cognitive processes, but also is especially concerned with the affective development of students...Its approach to learning is holistic...it would be a mistake to equate college education with career preparation... [General Education] should meet its commitment to enable students to learn whatever is necessary to be effective human beings..."[121] These quotations, taken from the Draft Document issued by the Committee, formed part of a survey conducted at Miami-Dade September 1, 1976. With 283 respondents, 52 percent (n = 147) "agreed substantially" with goals of general education based upon the above excerpted quotation, 34 percent (n = 95) "agreed but with reservations," and 12 percent (n = 35) "disagreed substantially."[122]

Although only a minority disagreed, their comments are of interest for they do parallel the kinds of negative responses that one might voice over the perspective that gave rise to Confluent Math. Again we quote from the General Education Study Committee's findings. "Several faculty responded that the values cited in the rationale were idealistic and beyond the scope of the community college...A couple of respondents emphasized vocational preparation and its implication for social and economic mobility--too much general education is irrelevant...Some faculty reject entirely any goals dealing with behavior, especially as related to the field of psychology. One expressed it this way: 'Adjustment should not replace mastery of subjects; adjustment should be left to psychologists.'...some felt that the College should worry less about integrating knowledge and

more about giving students something to work with...several faculty [asserted] that affective development is not a direct concern [of general education]."[123]

These minority objections do indicate the philosophic support existing by the majority of Miami-Dade's academic community in terms of the direction of the MARP product. Obviously in a climate emphasizing vocational cognitive education, the present MARP would not have been possible. However, if we turn our attention to the Department of Mathematics at Miami-Dade North, a somewhat different picture emerges.

As part of his work on a committee studying competency based education, a Mathematics Department member asked other mathematics faculty to rank twelve items in terms of their order of importance within General Education Mathematics. The rankings (from 1 = most important to 12 = least important) are indicated below:[124]

1. Critical thinking
2. Problem solving
3. Mathematics as a way of thinking
4. Mathematics as a language
5. Mathematics and Science
6. Mathematics and computers
7.5. Description of algebra
7.5. Description of probability and statistics
9.5. Mathematics and philosophy
9.5. Mathematics and culture
11. History of mathematics
12. Description of analysis

The list is interesting both in terms of what it does as well as what it does not contain. Nowhere do we find the Confluent Math notion "mathematical themes and self-awareness," and in a sense this comes as no surprise. We mentioned earlier that the Confluent Math product was shared with members of the Miami-Dade academic community. The largest

single objection came from the mathematics faculty over the integration of mathematical and Gestalt themes. One typical verbatim response, "I thought it was great until I got to the Gestalt dreamwork which left me cold," indicates the degree to which affective (awareness) education is foreign to those trained in an area as highly cognitive as mathematics. Numerous math persons echoed the cry that "adjustment be left to the psychologists," bringing forth the often mentioned way in which Confluent Math is tied into the MARP author's unique educational background. The idea of including "mathematics and self-awareness" in a list of competencies would probably occur to few mathematics educators. Our conjecture is that if this category were included in the previous ranking it would fall into a dismal last place.

However, there is also much that is contained in the first seven rankings that is uniquely developed in Confluent Math. "Mathematics as a way of thinking," along with other modes of knowing, is one of the crucial themes interwoven throughout the product. (One wonders at the distinct separation of this competency from "mathematics and philosophy" and the discrepancy between the rankings of the two areas.) "Mathematics as a language" is also uniquely presented in Unit III where the product deals with moving beyond a content language to an artificial language of pure form. "Mathematics and Science" forms the basis for all of Unit V, discussing computers and pure mathematics, artificial intelligence, and political issues involving computer abuse. The "description of algebra" is more accurately developed in Unit IV as the "structure behind algebra," although the structure is presented

in a way to illuminate particular descriptive techniques.

Since Confluent Math does deal with these top-ranked competencies in interesting and unusual ways, it would be unwise to affirm, "Oh well the affective portion of the product precludes its use by anyone in the Department other than the MARP author," since even this is only a portion of the product. The Mathematics Department ranked "critical thinking" and "problem solving" in the top two positions, an emphasis that might be partly responsible for students in control sections of MAT 201 viewing mathematics as arithmetic procedures for solving problems. As an art form, mathematics is so much more than this, and it is believed that some sort of balance should be incorporated into existing MAT 201 to broaden students' perspectives toward the subject. One way to present this balancing perspective would be to include portions of Confluent Math in sections of MAT 201 not taught by the author.

But aren't we just going around in circles? If enough Math faculty are turned off to a non-superficial dosage of affective education, then why bother to consider the balancing effect of a product that will never be used? What is needed is a short brochure, made available to all members of the Mathematics Department, describing various ways that parts of Confluent Math could be used with their present text and their own curriculum approach. This pamphlet would follow the chapter format of the three texts now used in MAT 201. In order to give the reader a feeling for what we mean, consider the following illustration for chapter 6 ("Mathematical Systems") of Bosstick and Cable's Patterns in the Sand.

Chapter 6. Frequently the notion of structure in mathematics is masked by the arithmetic nature of solving problems, giving students the impression that mathematics is arithmetic. If you wish to develop some of the ideas in this chapter in greater detail, the following selections are available for class use:

"The Mathematical Art Form" I use the discussion in section 6.1 to talk about the nature of abstract structure, tying this in with a play by Edward Albee, Plato's analogy of the cave (and why he thought structure was of crucial significance for the curriculum of the philosopher-King), psychologist Jean Piaget's work with numbers and children, and mathematician Godel's important finding that mathematical structure is always incomplete. The first 16 pages simply reinforce, in an interdisciplinary sense, the comments made in the text.

Pages 16 - 24, using the Boolean structure as an illustrative example of a mathematical system can be omitted.

Some of the exercises on pages 25 - 46 may be of interest. Exercise 1 presents perspectives about the nature of mathematics. I usually ask my students to tell me which quotations would be uttered by persons who spent their time creating mathematical structure and which would not. I then ask them to justify their position in terms of their understanding of mathematical systems. You may also wish to elicit your students' personal opinions about the ideas within the quotes.

Exercise 9 (page 32) is wild! It involves a small group activity in which intuitive creative ideas parallel the intuitive process of the abstract mathematician. I've found that this exercise helps students appreciate the creativity behind mathematical structure.

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The faculty handout for Confluent Math would continue in this fashion, very specifically indicating how parts of existing materials could enrich all curriculum-text processes. In addition, the MARP author plans to share the general innovative philosophy behind Confluent Math with the Mathematics Department Subcommittee in charge of General Education Mathematics. These future directions, designed to give the product impact beyond sections taught by the author as well as to (at least) balance the math-as-arithmetic outlook, have

up to this point been pre-empted by time factors involving creating the product, creating the evaluative design of the product, and conducting the research. We know the "operation was a success" but now we find it equally important that the "patient live." For the MARP author, the dynamics of his successfully-tested product can now first begin to do this!

Part of this "life" involves a six-credit multidisciplinary course to be taught for the Fall term of the 1977-78 academic year--exactly one year from the time the experimental section of the present study began its work with the product-course. One criticism that many students voiced at the end of MAT 201 was that there was simply too much material "packed" into one course, with too little time spent on the awareness goal. The reader, after surveying the product in chapter 3, no doubt got the feeling that the course really does "contain multitudes." One solution involves the expansion of Confluent Math into a six-credit course meeting six hours (rather than three hours) per week. Students will receive credit for both MAT 201 (3 credits-General Education Mathematics) and PSY 291 (3 credits-Psychology of Human Potential). At this writing the course, mutually supported by the chairpersons of the Mathematics and Behavioral Sciences Departments, is listed among the Miami-Dade North course offerings for the Fall 1977-78 semester.

Miami-Dade Community College offers two three-credit mathematics courses for elementary education majors. These courses (MAT 204: Mathematics I for Elementary Education Majors and MAT 206: Mathematics

II for Elementary Education Majors), not intended as a substitute for a "Methods of Teaching Mathematics in the Elementary School," use the survey curriculum approach, rationally presenting topics in sets, numeration systems, logic, statistics, and algebra. Since these topics are all dealt with in Confluent Math (within a broader unifying framework) and since many of the exercises in Confluent Math raise issues dealing with education, the Miami-Dade North Mathematics Chairperson felt that the product, taught by the MARP author, would be ideally suited for either MAT 204 or MAT 206. This position was reinforced by the outcome of the present study. If the product-instructor interplay really did elevate both math appreciation and the understanding of aesthetic qualities of structure, this effect should also take place within the MAT 204 (or MAT 206) population. This outcome may be more important for a group of elementary school teachers-to-be than for the group used in the present study. If dread over mathematics is partly transmitted by elementary school teachers who, in subtle ways,let their students know that they themselves neither enjoy or really understand the nature of the subject beyond solving numerical problems, then the "gospel of Confluent Math" cannot find a better group than those persons who will be teaching the subject to our children, transmitting both content as well as attitudes toward mathematics.

It should be noted that the population which takes MAT 204 (or both MAT 204 and MAT 206) substitutes this sequence for MAT 201, using the course (or courses) to satisfy general education requirements in

mathematics. At the present writing, the MARP author is planning to teach one of these courses for the Fall 1977-78 semester. The organization of the course is indicated (briefly) in the outline listed below. A project that students will be required to work on involves taking one of the perspectives toward mathematics and generating it into a lesson plan appropriate for the grade they wish to teach. The idea is similar to the practicum concept now used by Nova University.

Mathematics for Elementary Education Majors

I. The Nature of Mathematics
Weil - The Natural Mind
Blitzer - "The Mathematical Art Form"

II. An Example of Mathematics: Symbolic Logic
Blitzer - "Introduction to Logic"
"The Theorems of Logic"
"Validity of Arguments"
Kupperman - "Fallacies in Everyday Life"

III. Mathematics and Art
Halmos - "Mathematics as a Creative Art"

IV. The Aesthetics of Algebra
Blitzer - "Introduction to Group Theory"
"Group Theory and Algebraic Equations"
Keyser - "The Mind as Group"

V. Mathematics is Not Science
Blitzer - "The Methodology of Straight Thinking"
"The Computer"

VI. (Optional, depending on time). The Unusual Mathematics of Infinity.
Blitzer - "Infinity and Higher Consciousness"
Abbott - Flatland
Ouspensky - Tertium Organum

The Mathematics Department of Miami-Dade Community College currently offers a statistics course (MAT 251 - Statistical Methods)

that devotes an extensive amount of time to probability theory and probability distributions, time which takes away from actually applying statistical procedures to problems of inductive research. Also planned for the Fall 1977-78 semester is a special section of MAT 251 emphasizing statistics in social research, to be taught to sociology, psychology, and education majors, students who now complain about the highly theoretical nature (exclusing actual research) of MAT 251. This special section, to be taught by the MARP author, will use Jack Levin's Elementary Statistics in Social Research and three readings from the Confluent Math product that evaluate the pros and cons of inductive research as a way of knowing. These readings include:

Weil - (selections from) The Natural Mind

Blitzer - "The Methodology of Straight Thinking"

Blitzer - "The Computer"

In this area, the MARP author's educational background puts him into a unique position to construct a statistics course that will be meaningful to those eventually engaged in social research, while integrating parts of the "How doe- one know?" motif from Confluent Math into this course. Once again the course, a-proved by chairpersons from the Departments of Mathematics and Social Science, is listed among the Fall 1977-78 course offerings at Miami-Dade Community College North.

Thus the future possibilities involving Confluent Math are aimed at a faculty handout explaining specifically how the product

can enrich existing MAT 201 text-curriculum practices, using the materials in a six-credit math-psychology course, a three credit math sequence for elementary education majors, and a portion of the readings in a statistics course centered around social research. These future possibilities are based on the present research. Consequently we conclude by looking, once again, at the alternate hypotheses listed with chapter 2, briefly summarizing the major findings of the MARP study. We then tie together these future possibilities in a list of formal recommendations.

Alternate Hypothesis 1. The MARP product, emphasizing the mathematical art form within an interdisciplinary framework, will lead to a more positive attitude toward mathematics on the part of the learner. This change will be most pronounced for area preference types I and II and least pronounced for types III and IV.

What We Actually Found. We can be 99 percent sure that the product-course-instructor interplay caused a significant upward change in mathematical attitudes. This upward shift was true regardless of one's initial area preference type. However, a much higher percentage of type III and IV persons withdrew from the course (and were not included within the data) than types I and II.

Alternate Hypothesis 2. The participant using the MARP product will experience an increased understanding of the nature of mathematics as an abstract art form.

What We Actually Found. Again, we can be 99 percent certain that the product-course-instructor interplay caused an increase in the

understanding of aesthetic qualities of mathematical structure. Again this upward shift occurred regardless of one's initial area preference type.

Alternate Hypothesis 3. The participant using the MARP product will gain increased resources in order to promote self-growth and self-awareness. This will be most pronounced for area preference type III.

What We Actually Found. We can accept this third hypothesis with 95 percent certainty. Only in this category did initial area preference types make a difference. The course goal involving self-growth had significantly more impact on type I and II than on type III individuals.

Alternate Hypotheses 4 and 5. The 29-item pre-test will be quite reliable, with coefficient alpha for each category as well as the overall instrument reflecting the high internal reliability. Furthermore many significant correlations will exist between the items on the pre-test. Positive correlations will also be high between categories A and B, and categories A and D.

What We Actually Found. A number of "problem" items, discussed in chapter 4 (items conjuring up psychopathology; items in which students distorted answers in order to give the instructor a good initial impression, etc.) lowered coefficient alpha for the overall instrument (.659), particularly on categories B and C. Since extensive data were collected via verbatim responses, it was decided (based on a suggestion by the Testing and Research Department at Miami-Dade

Community College North) to retain all questions but to consider the 29-item pre-test as four separate instruments, using quantitative data to reinforce verbatim results. The instruments measuring the four categories had internal reliabilities of .817 (category A), ,19 (category B), .361 (category C), and .63 (category D). Although positive correlations did exist between pre-test (category test) items, even the highest of those just missed being significant at the 5 percent level. Testing-Research did note that any numerical value greater than .3 in the next to last column of Tables IX through XII indicated a relatively strong item correlation with the category instrument, found throughout Table IX, part of Table XI, and Table XII (minus item 10).

Alternate Hypothesis 6. Attitudes toward mathematics and an understanding of the nature of mathematics as an abstract art form will be significantly higher in the groups using the MARP product than those receiving the usual treatment.

What We Actually Found. The traditional MAT 201 approach was as successful in elevating math attitudes as the Confluent Math approach, but not in transmitting the aesthetic qualities of mathematical structure. We can be 99 percent certain that the experimental group saw mathematics in quite a different light from the control group (who viewed mathematics as a set of arithmetic procedures for solving problems), although the two groups did not differ significantly in their appreciation of these math perceptions.

Based on these findings we offer the following set of recommendations.

1. The MARP author should prepare a Confluent Math handout for Miami-Dade North Mathematics faculty explaining how the materials could be incorporated into existing curriculum-textbook designs. Use of these materials, deemed important to counter balance the math-as-arithmetic perspective, should be encouraged through both this handout and through a presentation given by the MARP author to the Mathematics Subcommittee of Miami-Dade North in charge of General Education Mathematics.

2. Confluent Math should form the basis of a six-credit MAT 201 (General Education Mathematics) PSY 291 (Psychology of Human Potential) interdisciplinary course to be taught by the author at least once a year at Miami-Dade Community College North.

3. Confluent Math materials, taught by the author, should be incorporated into the "Mathematics for Elementary Education Majors" math sequence currently offered at Miami-Dade.

4. Some of the Confluent Math materials (The Natural Mind; "The Methodology of Straight Thinking;" "The Computer") should be used in the special section of MAT 251 emphasizing elementary statistics within the framework of social research.

5. Confluent Math should continue to form the basis of a three-credit MAT 201 course that would be taught by the MARP author. At least two sections of this class should be given within each academic year.

6. Further work should be done with the part 2 pre-test (which determined area preference types) to see if the instrument is a good predictor of who will not complete the course described under recommendation #5. Students entering the Confluent Math MAT 201 should be required to complete this instrument, given data regarding the percentage of persons of types III and IV who have withdrawn from the class in the past, and (along with a description of the philosophy and direction of the course) be allowed to switch to a different section if they initially feel the course is not suited to their needs.

7. The population of the course listed under recommendation #5 should not include people deficient in reading, writing, and basic computational skills.

As we stated at the onset of this chapter, these recommendations (and the direction of this project) are intended to have impact for the MARP author that transcends the closing of this paragraph. These future plans, generating much in-person counseling with students over the direction of their awareness projects, also carry the implicit recognition of the author's continued growth as a counselor-facilitator, using his own inventiveness for integrating Gestalt techniques into the traditionally cognitive classroom. The affective-cognitive growth of the author throughout the duration of this project, and his continued development as a mathematics educator and Gestalt counselor, is the real energy source behind what has been accomplished thus far and the future possibilities lying ahead.

NOTES

[1] P. R. Halmos, "Mathematics as a Creative Art," Readings for Mathematics; A Humanistic Approach, ed. G. Joseph Wimbish, Jr. (Belmont, California: Wadsworth Publishing Company, Inc., 1972) pp. 15-16.

[2] S. M. Dowdy, Mathematics: Art and Science (New York: John Wiley and Sons, Inc., 1971), p. viii. The Dowdy text is an excellent illustration of the deductive axiomatic approach, employing the multiple thought pattern of the research mathematician: intuition experimentation, inductive eliciting of patterns, presentation of the system in a rigorous framework with proof. The actual proofs employed by Dowdy are quite abstract, although rationalization for the statement of the theorems is developed through inductive examples.

[3] Cassius J. Keyser, "The Group Concept," The World of Mathematics, ed. James R. Newman (New York: Simon and Schuster, 1956), pp. 1552-1554.

[4] Jack C. Gill, Mathematics and the Liberal Arts (Columbus, Ohio: Charles E. Merrill Publishing Company, 1973), p. IX. Gill, an instructor in the Mathematics Department at Miami-Dade North, employs a step by step carefully explained (with behavioral objectives listed throughout) survey approach in this audio-tutorial text. Each chapter (logic, sets, algebra, probability, statistics, number bases) has a counterpart, an audio-tutorial chapter that one can use on one's own with tapes that correspond to the text explanations. Providing short explanations and problems to try, Gill's innovative idea enables many students at Miami-Dade Community College to take General Education Mathematics on their own using the text and tutorial tapes, coming to the college only to take the chapter examinations (Miami-Dade's "Open College" program, enrolling approximately 50 students during Fall or Winter semesters).

Gill's text is also used in some "regular" lecture sections of General Education Mathematics at Miami-Dade North, along with Maurice Bosstick and John L. Cable (also instructors at Miami-Dade North), Patterns in the Sand (Beverly Hills, California: Glencoe Press, 1971) and Bruce E. Meserve and Max A. Sobel, Introduction to Mathematics (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964). Each instructor is free to choose whatever text he/she wishes to use, including a different volume from these three or no text at all.

[5] Stanley Gudder, A Mathematical Journey (New York: McGraw-Hill Book Company, 1976), pp. 54-115. In this innovative chapter entitled "Mathematics and Art" Gudder discusses mediums of art, proportion, order, perspective, symmetry, surrealism, optical art, art and Gestalt psychology, synthesizing the ideas of mathematicians, artists, poets, and philosophers. To date, this is the most complete treatment of the topic of art and mathematics, an area of emerging textbook interests among General Education Mathematics works using the survey curriculum approach.

[6] Game theory is another unit which is increasingly emerging as a "unique" chapter among the usual sections on probability, statistics, logic, algebra, sets, and number bases found in General Education Mathematics texts. These "unique" sections are often the chapters that serve to make real distinction from one text to another among those using the survey approach. Game theory to date is treated quite extensively in Joseph Newmark and Frances Lake, Mathematics as A Second Language (Reading, Massachusetts: Adison-Wesley Publishing Company, 1974), pp. 280-296.

[7] General Education Study Committee (at Miami-Dade Community College), Draft Document (unpublished, May 1, 1976),pp. 27-31.

[8] There is some question as to where the texts emphasizing the basic skills approach ought to be used. Should they form the content of General Education Mathematics or should they be used in a "lower level" usually non-transferable course called "College" Arithmetic? A good example of a work that can stir this placement debate is James Cooley, Basic Mathematics Review For The Liberal Arts Student (New York: The MacMillan Company, 1970).

[9] General Education Study Committee, op.cit., p. 29.

[10] G. Joseph Wimbish employed this approach in two separate volumes that complemented one another. His text, a sort of philosophic survey: G. Joseph Wimbish, Mathematics: A Humanistic Approach (Belmont, California: Wadsworth Publishing Company, 1972) was reinforced through his collection of readings by Plato, (mathematician) P. R. Halmos, Lewis Carroll, and others: G. Joseph Wimbish, Readings For Mathematics: A Humanistic Approach (Belmont, California: Wadsworth Publishing Company, 1972). It was the MARP author's exposure to these volumes that initially suggested moving beyond the survey approach. In fact, as we shall see, two of the readings used within the MARP product (P. R. Halmos, "Mathematics As A Creative Art" and Edwin Abbott, "Flatland") appeared in the Halmos anthology.

11 "American Council on Education, A Design for General Education: for Members of the Armed Forces (Washington, D. C.: American Council on Education, 1944).

12 Harold Taylor, "The Philosophical Foundations of General Education," Fifty-First Yearbook of the National Society for the Study of Education: Part I - General Education, ed. N. B. Henry (Chicago: University of Chicago Press, 1952).

13 George Isaac Brown, Human Teaching for Human Learning (New York The Viking Press, 1971), pp. 3-5.

14 Louis J. Rubin, "Schooling and Life," Facts and Feelings in the Classroom, ed. Louis J. Rubin (New York: The Viking Press, 1973), p. 24.

15 General Education Study Committee, op.cit., p. 16.

16 Stanley O. Ikenberry, "The Academy and General Education," CSHE Report, 7 (December 1970), p. 20.

17 E. J. Shoben, Jr., "The Liberal Arts and Contemporary Society: The 1970's," Liberal Education 56(1970), pp. 33-34.

18 J. Bronowski, The Ascent of Man (Boston: Little, Brown and Company, 1973), pp. 154-187.

19 George Isaac Brown, op.cit., p. 8.

20 George B. Leonard, Education and Ecstasy (New York: Dell Publishing Company, Inc., 1968), p. 11.

21 Ibid., p. 123.

22 Sterling, M. McMurrin, "What Tasks for the Schools?" Saturday Review, January 14, 1967, p. 41.

23 Ibid.

[24] Louis J. Rubin, op. cit., p. 18.

[25] Abraham Maslow, "What is a Taoistic Teacher?" Facts and Feelings in the Classroom, op.cit., p. 159.

[26] Ibid., p. 158.

[27] Ibid., p. 160.

[28] John H. Flavell, The Developmental Psychology of Jean Piaget (Princeton, New Jersey: Von Nostrand, 1963), p. 62.

[29] Richard M. Jones, "Involving Fantasies and Feelings," Facts and Feelings in the Classroom, op. cit., p. 191.

[30] Bertrand Russell, Mysticism and Logic and Other Essays (London: George Allen and Unwin Ltd., 1910), pp. 12-18.

[31] A. H. Maslow, The Farther Reaches of Human Nature (New York: The Viking Press, 1971), pp. 59-60.

[32] Ibid., p. 100.

[33] Richard I. Evans, Jean Piaget: The Man and His Ideas (New York: E. P. Dutton and Company, Inc., 1973), p. 49.

[34] Robert Blitzer, "The Mathematical Art Form" (unpublished; from the first draft of the selection--now being rewritten--1975), pp. 21-23.

[35] George B. Leonard, op.cit., p. 135.

[36] William Barrett, "Science and Finitude," Our Mathematical Heritage, ed. William L. Schaaf (New York: Collier Books, 1963), p. 206.

[37] Ibid.

38 Andrew Weil, The Natural Mind (Boston: Houghton Mifflin, 1972) pp. 119-124.

39 Frederick S. Perls, Gestalt Therapy Verbatim (New York: Bantam Books, 1969), p. 24.

40 Richard I. Evans, op.cit., p. 95.

41 Andrew Weil, op.cit., p. 157.

42 Ibid.

43 Jean Piaget, Main Trends in Interdisciplinary Research (New York: Harper and Row, 1970), p. 29.

44 Ruth M. Beard, Piaget's Developmental Psychology (New York: Basic Books, Inc., 1969) pp. 101-102.

45 Walt Whitman, "Song of Myself," The American Tradition in Literature--Volume 2, eds. Sculley Bradley, Richmond Beatty and E. Hudson Long (New York: Grosset and Dunlap, Inc., 1967), p. 84.

46 Andrew Weil, op.cit., pp. 179-180.

47 Frederick S. Perls, op.cit., p. 19.

48 Ibid.

49 Ibid., p. 72.

50 P. D. Ouspensky, Tertium Organum (New York: Vintage Books, 1970), p. 236.

51 Heinrich Zimmer, The King and the Corpse (Princeton, New Jersey: Princeton University Press, 1956), pp. 34-35.

52 Carlos Castaneda, The Teachings of Don Juan: A Yaqur Way of Knowledge (New York: Ballantine Books, 1969), p. 127.

[53] A. H. Maslow, op.cit., p. 60.

[54] Bertrand Russell quote in James R. Newman (ed), The World of Mathematics, op.cit., p. 1773.

[55] Swami Prabhavananda and Christopher Isherwood (translators), Bhagavad-Gita (New York: Mentor Books, 1944), p. 42.

[56] Lewis Carroll, Alice's Adventures in Wonderland and Through the Looking Glass (New York: Meridian Books, 1960), p. 91.

[57] Marianne S. Andersen and Louis M. Savary, Passages: A Guide for Pilgrims of the Mind (New York: Harper and Row, Publishers, 1972), p. 161.

[58] The human pronoun is used throughout the MARP proposal, with

Te (pronounced like tea) = he OR she (objective)
Tes = his OR her (possessive)
Tir (rhymes with her) = him OR her (objective)

The human pronouns are only used in place of a pronoun that could be referring to either a man or a woman. Each consists of "t" plus one letter from both the masculine and feminine gender of the old pronouns.

[59] Lewis Carroll, op.cit., p. 269.

[60] Sidney B. Simon, Leland W. Howe, and Howard Kirschenbaum, Values Clarification (New York: Hart Publishing Company, Inc., 1972), p. 13.

[61] From a student's response to the exercise "Your Life As A Mathematical Structure." The exercise, outlined briefly in the MARP proposal, is carefully described within the MARP product.

[62] In the separate document (Confluent Math) accompanying the MARP. we have not included selections not authored by Mr. Blitzer. However these articles are outlined within chapter 3. In addition, the exact source and pages used are indicated within the notes. For this first selection, we have: Andrew Weil, op.cit., pp. 116-135 and pp. 149-159.

[63] Walt Whitman, op.cit., p. 85.

[64] Andrew Weil, op.cit., p. 120.

[65] Frederick S. Perls, op.cit., pp. 65-66. Directions given within this exercise are more explicit than those informally set down by Perls.

[66] Kahlil Gibran, The Prophet (New York: Alfred A. Knopf, 1961), pp. 53-54.

[67] J. L. Synge, "Euclid and the Bright Boy," The Mathematical Magpie, ed. Clifton Fadiman (New York: Simon and Schuster, 1962), pp. 215-218.

[68] Bertrand Russell, op.cit., pp. 25-55.

[69] Edwin A. Abbott, Flatland, Readings for Mathematics: A Humanistic Approach, op.cit., pp. 100-101 and pp. 107-118.

[70] Aldous Huxley, The Doors of Perception (New York: Harper and Row, 1954), p. 20.

[71] Edwin A. Abbott, op.cit., p. 118

[72] P. D. Ouspensky, op.cit., pp. 219-243.

[73] Lewis Carroll, op.cit., pp. 268-269.

[74] Ibid., pp. 262-263, 269-270.

[75] "Can't Anyone Here Speak English?," Time Magazine, August 25, 1975, p. 35.

[76] Ibid., p. 36.

[77] Joel Kupperman and Arthur S. McGrade, Fundamentals of Logic (New York: Doubleday and Company, Inc., 1966), pp. 232-243.

[78] P. R. Halmos, op.cit., pp. 13-29.

[79] A. H. Maslow, op.cit., pp. 177-178.

[80] Carl H. Denbow and Victor Goedicke, "Group Theory and the Postulational Method," Readings for Mathematics: A Humanistic Approach, op.cit., pp. 132-141.

[81] Cassius J. Keyser, op.cit., pp. 1552-1557.

[82] Ken Keyes, Jr., Handbook to Higher Consciousness (Berkeley, California: Living Love Center, 1973), pp. 165-166.

[83] George B. Leonard, op.cit., pp. 113-114.

[84] Lillian R. Lieber, The Education of T. C. Mits (New York: W. W. Norton and Company, Inc., 1942), pp. 124-125.

[85] Lillian R. Lieber, Infinity (New York: Rinehard and Company, Inc., 1953), p. 340.

[86] Ibid., p. 97.

[87] Lillian R. Lieber, Human Values and Science, Art and Mathematics (New York: W. W. Norton and Company, Inc., 1961), p. 113.

[88] J. Krishnamurti, "Education and the Significance of Life," Transpersonal Education, eds. Gay Hendricks and James Fadiman (New Jersey: Prentice-Hall, Inc., 1976), p. 41.

[89] Frederick S. Perls, op.cit., p. 4.

[90] One volume containing a wealth of consciousness expanding techniques is Min S. Vee, ed., The Great Escape (New York: Bantam Books, 1974).

[91] All quantitative data collected by the MARP author were submitted to the Miami-Dade North Department of Testing and Research. The author gave the Department a specified procedure indicating how he wanted the data treated. Actual computations were performed by the computer according to programs written by Dr. Tien Lin of Testing and Research (based on the MARP author's specifications). The verbatim responses quoted throughout this chapter indicate exact excerpts of students' replies and consequently are quoted without correcting errors in grammar or spelling.

[92] Gay Hendricks, "Educators' Checklist: Questions to Ask Ourselves About Schooling," Transpersonal Education, op.cit., pp. 43-44.

[93] Course offered at Miami-Dade that are consistent with the area preference types (in terms of satisfying one's math requirement) include MAT 204 (Finite Mathematics), APM 162 (Applied Mathematics), APM 182 (Applied Mathematics for Electronics) for Type III persons; MAT 101 (College Arithmetic), MAT 120 (Techniques of Algebra) for Type III persons; MAT 251 (Special section emphasizing statistics in social research) for Type V persons.

[94] Dr. Tien Lin, program author, "Confluent Math Phase I," January 28, 1977.

[95] Bonnie Donady, Stanley Kogelman, and Sheila Tobias, "Math Anxiety and Female Mental Health: Some Unexpected Links," (work in progress; not for publication, August 4, 1976), pp. 1-2.

[96] Ibid., pp. 10-12.

[97] Dr. Tien Lin, op.cit.

[98] Ibid.

[99] Ibid.

[100] Bonnie Donady, op.cit., pp. 4-5.

[101] Dr. Tien Lin, op.cit.

[102] Dr. Tien Lin, program author, "Confluent Math Phase II," February 11, 1977.

[103] Ibid.

[104] The multivariate analysis of variance was run by Dr. Fred Smith of Testing-Research (Miami-Dade Community College North) according to the directions given by the MARP author. Dr. Smith employed a program distributed by Clyde Computing Service (Box 166, Coconut Grove Station, Miami, 33133), March 23, 1977. Data were treated under the name, "Confluent Math Phase IV."

[105] Dr. Tien Lin, program author, "Confluent Math Phase III," February 23, 1977.

[106] Ibid.

[107] Once again, responses are excerpted verbatim with no attempt made to correct errors in spelling or grammar. Students were told that it was conceivable a part of their awareness project might appear in the author's MARP. Students were given the option of marking part or all of their projects "not for use," indicating to the MARP author that he could not use their work in his study. Approximately fifteen projects fell into this category and are not either reproduced or referred to within the text.

[108] Frederick S. Perls, op.cit., p. 108.

[109] Robert Blitzer, "Bisexual Liberation" (unpublished, 1975), p. 5.

[110] Warren Farrell, The Liberated Man (New York: Random House, 1974), pp. 52-56.

[111] Ibid., p. 38.

[112] Ibid., p. 171.

[113] Ibid., p. 37.

[114] Ibid., p. 38.

115 Ibid., pp. 54-55.

116 Guy Bolton and Jerome Kern, Leave It To Jane. Lyrics are taken directly from the cast album of this 1917 musical.

117 M. Yvain, "My Man" (New York: Leo Feist, Inc., 1921).

118 Don Clark, "Homosexual Encounter in All-Male Groups," Men and Masculinity, eds. Joseph Pleck and Jack Sawyer (New Jersey: Prentice-Hall, 1974), p. 93.

119 Warren Farrell, op.cit., pp. 11-12.

120 Warren Farrell, op.cit., p. 10.

121 General Education Study Committee (of Miami-Dade Community College), Summary of Draft Document and Responses to the Faculty Survey (unpublished, October 11, 1976), pp. 6-10.

122 Ibid., p. 13.

123 Ibid, pp. 14-17.

124 Dale Grussing, "Summary of Survey on Competencies in General Education Mathematics" (unpublished).

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APPENDIXES

Appendix A: Pre-test for Experimental Group

Directions: Part 1

This instrument is designed to examine your attitudes and feelings within certain areas. Please respond to each item with the following number system:

1 = STRONGLY DISAGREE with the statement

2 = DISAGREE with the statement

3 = NO OPINION one way or the other

4 = AGREE with the statement

5 = STRONGLY AGREE with the statement

There are obviously no "correct" answers, so simply respond to each item by the way you honestly feel right now.

---

*1. I wish I didn't have to take a math course.

**2. Arithmetic computation is essentially what mathematics is all about.

***3. When I have personal problems or conflicts, I know a number of techniques which I can use to work things out.

*4. I have a mental block about mathematics.

**5. Mathematics is a complete system where everything can be proved true or false.

*6. I enjoy mathematics.

****7. On the whole, I am satisfied with my work in school.

**8. Mathematics deals primarily with a description of situations and things in the real world.

****9. I frequently feel ill at ease in class.

****10. General speaking, I'm pretty good student.

**11. Mathematics is related more to philosophy or art than it is to science.

12. My background in mathematics is pretty good.

***13. I do not know many techniques that I can use in order to discover more about my feelings and with which I can gain greater self-awareness.

***14. Many of the things in my background (parents, family, teachers, society, religion, etc.) really messed me up.

*15. I appreciate mathematics.

**16. Mathematics involves learning certain procedures and applying them to solve problems, rather than true artistic creativity.

****17. School is a real drag.

****18. Even when I don't understand something, its' hard for me to ask the teacher a question.

**19. I have a good idea of what mathematics is.

***20. I feel that nothing, or almost nothing, can change the opinion that I currently hold of myself.

*21. Mathematics makes me feel inadequate.

*22. Suppose that you just got back a mathematics examination. Which grade are you likely to receive on this exam.

1. A - Excellent or outstanding.
2. B - Good; above average
3. C - Average
4. D - Slightly below average
5. F - Unsatisfactory; Failing

****23. Suppose that you have just completed four years of college. Which grade do you think would best reflect your overall average for four years of college courses?

1. A
2. B
3. C
4. D
5. F.

Directions: Part 2

There are six items on this part of the instrument. EACH item is followed by five choices which you are to RANK FROM 1 TO 5 with

1 = MOST PREFERRED
2 = SECOND MOST PREFERRED
3 = THIRD MOST PREFERRED
4 = FOURTH MOST PREFERRED
5 = LEAST PREFERRED (Of the available choices)

The example below illustrates how the items are presented. Examine it carefully to be sure you understand how you are to mark your answers.

SAMPLE: Rank the following colors in the order which you generally prefer them.

a. Yellow
b. Red
c. Blue
d. Green
e. Orange

SAMPLE OF HOW THE ANSWER KEY IS MARKED:

a. 5 (least preferred)
b. 1 (Most preferred)
c. 3 (third)
d. 2 (second)
e. 4 (fourth)

Notice that you must write a number in each blank on your answer sheet to indicate how well each response expresses how you feel. All five responses must be ranked (from 1 to 5) for each of the six questions. Please do not use ties.

---

1. Rank the following in terms of how well they describe classes you've liked most.
   a. I discovered more about myself and my feelings, as well as the feelings of the other people in the class.
   b. I set my own goals and studied the things that were of interest to me.
   c. The course was well organized and ideas were presented in interesting ways so that I acquired a lot of knowledge.
   d. The material covered in class was useful and practical in terms of what I do on a day to day basis OR in my chosen profession.
   e. I became more aware of social and political injustices that exist within the system.

2. If you were in a course that required everyone to visit a home for the elderly, and you could do any of the following, rank the items in the order of their interest to you.
   a. Help the elderly residents with their finances by balancing checkbooks, helping to compute income taxes, etc.
   b. Organize them politically so that they could deal more effectively with injustices toward the elderly.
   c. Help repair or replace something for them.
   d. Sit and talk with them about ideas, philosophies, and knowledge in general.
   e. Sit and talk with them about their feelings.

3. Rank the following in terms of what you think general education courses should do.
   a. Prepare people to find good jobs OR to teach things that will be useful for one's chosen profession.
   b. Expose people to ideas that will help them to think more critically and creatively, even if these ideas are of no immediate or practical value.

c. Help people to become more active in responding to injustices in the political, economic, and social structure.
d. Help people get a better idea of who they are, through increased self-awareness.
e. Teach people basic skills, such as reading, writing, arithmetic, and communication skills.

4. Rank the following in the order in which you enjoy doing them.
   a. Being active in politics (working to help elect a candidate, working to get a bill passed that you consider important, running for office, etc.)
   b. Sharing my feelings with other people and having them share their feelings with me.
   c. Working with numbers and performing computations.
   d. Gaining new knowledge and ideas.
   e. Building or repairing something.

5. Rank the following in terms of why you are in college.
   a. To learn about various ideas and become a better educated person.
   b. To get a good, well paying job.
   c. To learn more about myself.
   d. To establish a better social and/or sex life.
   e. To please my parents.

6. As a club member, please rank the following in terms of the order in which they appeal to you.
   a. Keeping the books on income, expenses, and finances.
   b. Organizing club membership in order to support a local bill that would end job and housing discrimination.
   c. Setting up the room prior to meetings and keeping club equipment in good working order.
   d. Greeting new members and helping everyone feel welcome.
   e. Coming up with new ideas for special club meetings.

Appendix B: Post-test for Experimental Group

Directions: Part 1

This instrument is designed to examine your attitudes and feelings within certain areas now that you have completed the "mathology" course. Please respond to each item with the following number system:

1 = STRONGLY DISAGREE with the statement

2 = DISAGREE with the statement

3 = NO OPINION one way or the other

4 = AGREE with the statement

5 = STRONGLY AGREE with the statement

By now you know me well enough to realize that I'm looking for the way you honestly feel right now. Indeed, if this instrument is to have any value at all, it is most important that you share your honest reaction to each of the items appearing below.

---

1. I wish I hadn't taken this math course.
2. Arithmetic computation is essentially what mathematics is all about.
3. When I have personal problems or conflicts, I know a number of techniques which I can use for working things out.
4. I have a mental block about mathematics.
5. Mathematics is a complete system where everything can be proved true or false.
6. I enjoy mathematics.
7. On the whole, I am satisfied with my work in school.
8. Mathematics deals primarily with a description of situations and things in the real world.
9. I frequently feel ill at ease in class.
10. Generally speaking, I'm pretty good as a student.
11. Mathematics is related more to philosophy or art than it is to science.

12. My background in mathematics is pretty good.

13. I do not know many techniques that I can use in order to discover more about my feelings and with which I can gain greater self-awareness.

14. Many of the things in my background (parents, family, teachers, society, religion, etc.) really messed me up.

15. I appreciate mathematics.

16. Mathematics involves learning certain procedures and applying them to solve problems, rather than artistic creativity.

17. School is a real drag.

18. Even when I don't understand something, it's hard for me to ask the teacher a question.

19. I have a good idea of what mathematics is.

20. I feel that nothing, or almost nothing, can change the opinion that I currently hold of myself.

21. Mathematics makes me feel inadequate.

22. Suppose that you just got back a mathematics examination. Which grade are you likely to receive on this exam?

    1. A - Excellent or outstanding
    2. B - Good; Above average
    3. C - Average
    4. D - Slightly below average
    5. F - Unsatisfactory; Failing

23. Suppose that you just completed four years of college. Which grade do you think would reflect your overall average for four years of college courses?

    1. A
    2. B
    3. C
    4. D
    5. F

Directions: Part 2

In constructing the "Mathology" course, I had three major goals in mind:

(mathematics) 1. The student will understand and appreciate logical axiomatic structure (mathematics as an art form).

(philosophy) 2. The student will examine major philosophic ideas that relate to the creation of axiomatic structure. Emphasis will be placed on contrasting ideas of logic and mysticism, as well as existential philosophies and therapies that arise from the incompleteness of pure mathematics.

(humanistic psychology; self-awareness)
3. The participant will use goals (1) and (2) listed above, along with techniques grounded in the Gestalt therapy theory of Dr. Frederick Perls, to gain increased self-awareness.

I would now like to know how successful (or unsuccessful) the "Mathology" course was <u>for you</u> in terms of meeting each of these three goals. On your response sheet, the three goals are listed, with a lot of blank space between them. Read each goal and write a statement for each indicating the degree to which that goal was accomplished for you. Try to be as specific as possible, relating your comments to the assigned readings (it would be a good idea to have the course packet listing all the readings in front of you), films,class discussions, attitude of the instructor, small group activities, problems and discussion questions following the readings, self-awareness exercises, what you actually did with the self-awareness exercises, dream work demonstrated in class, and whatever else you consider relevant.

The more honest feedback you give, the more valuable this questionnaire will be. Be sure to include areas you especially liked as well as those you especially disliked.

The response sheet contains one last item which reads, "Do you have any additional comments concerning the 'Mathology' course?". If there are things that you'd like to say but didn't express when responding to the three course goals, please do so. If not, simply leave this question blank.

Thank you for taking the time to fill out this form and sharing your personal reactions to the course goals.

Appendix C: Post-test for Control Group

Dear Student:

Current records indicate that you have just completed MAT 201, General Education Mathematics, at Miami-Dade north. I am one of the mathematics instructors at Miami-Dade, and am interested in finding out some of the attitudes and feelings toward mathematics that are held by people who complete General Ed. Math.

Could you take a moment or two to fill out this questionnaire by simply circling the number that corresponds to the way you now feel about each of the statements listed below? Circle:

1 if you STRONGLY DISAGREE with the statement

2 if you DISAGREE with the statement

3 if you have NO OPINION one way or the other

4 if you AGREE with the statement

5 if you STRONGLY AGREE with the statement

There are a total of twelve items on the enclosed questionnaire. Obviously, there are no "correct" answers, so simply respond to each item by the way you honestly feel right now.

Please do NOT sign your name or student number on the questionnaire.

A stamped addressed envelope is enclosed so that you can return the questionnaire.

Thank you for your time and your honesty.

Yours truly,

Bob Blitzer
Math Instructor at Miami-Dade North

P. S. If you'd like to know more about my research dealing with MAT 201 please feel free to contact me at 685-4403 (Miami-Dade Math Department, North Campus). Ask to speak with Bob!

Remember to circle:

1 if you STRONGLY DISAGREE with the statement

2 if you DISAGREE with the statement

3 if you have NO OPINION one way or the other

4 if you AGREE with the statement

5 if you STRONGLY AGREE with the statement

CIRCLE ONLY ONE NUMBER FOR EACH QUESTION

1.	I wish I had not taken General Ed. Math.	1	2	3	4	5
2.	Arithmetic computation is essentially what mathematics is all about.	1	2	3	4	5
3.	I have a mental block about mathematics.	1	2	3	4	5
4.	Mathematics is a complete system where everything can be proved true or false.	1	2	3	4	5
5.	I enjoy mathematics.	1	2	3	4	5
6.	Mathematics deals primarily with a description of situations and things in the real world.	1	2	3	4	5
7.	Mathematics is related more to philsophy or art than it is to science.	1	2	3	4	5
8.	I appreciate mathematics.	1	2	3	4	5
9.	Mathematics involves learning certain procedures and applying them to solve problems, rather than true artistic creativity.	1	2	3	4	5
10.	I have a good idea what mathematics is.	1	2	3	4	5
11.	Mathematics makes me feel inadequate.	1	2	3	4	5
12.	Suppose that you just got back a mathematics examination. Circle the grade that you think you'd most likely receive.	A	B	C	D	F